ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

APRIL 24, 1948

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ELECTRICAL WORLD

Published 74 years for those engaged in the business of generating transmitting, distributing or applying electric power

April 24, 1948 **CONTENTS** Vol. 129 No. 17

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Circling Alcoa's new 50-acre rolling mill at Davenport, Iowa, this overhead 13.8-kv loop supplies power to the mill site. Each phase of the loop consists of two 1,033,500 cir mil stranded aluminum cables in parallel groove clamps.

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COMING IN THE MAY 8 ISSUE

Wire Connections Need More Attention
Pumped Storage Hydro Costs Per Kw Are Competitive
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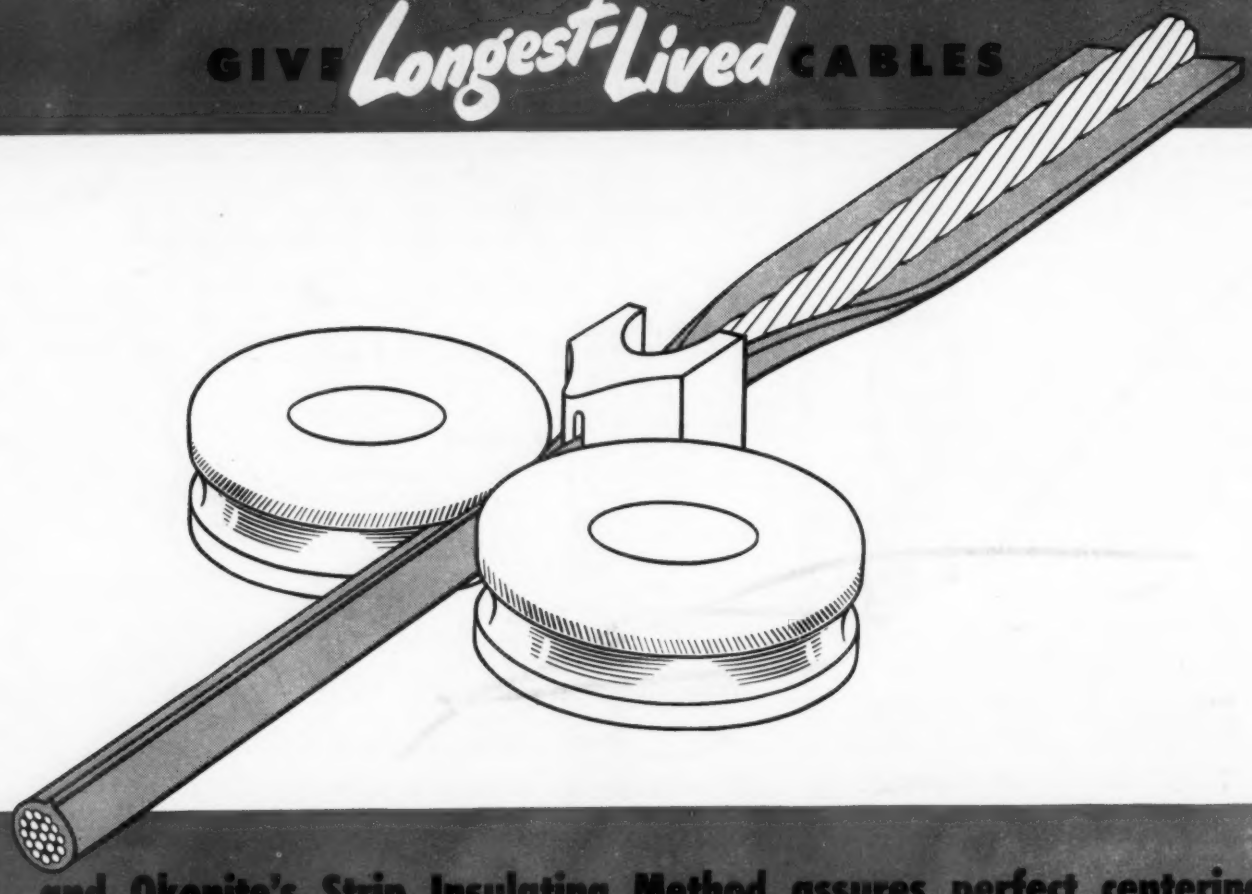
ONLY PERFECTLY-CENTERED CONDUCTORS GIVE *Longest-Lived* CABLES



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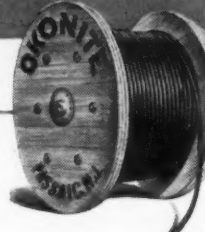
Here's what happens. Precisely-measured, smoothly-calendered strips of rubber compound pass through "covering wheels" and are individually folded around the conductor.

This procedure provides automatic centering. It eliminates uneven walls of insulation. And as a result, the Okonite Strip Method removes every chance of electrical failure from imperfect centering. The process is the same for all layers, except that the outside layer is backed with a pure tin sheet, forming a continuous metal mold to assure uniform vulcanizing.

Bulletin 101 gives you further information on the Up-River Fine Para rubber used in Okonite insulation as well as data on many manufacturing steps taken only by Okonite to build user-benefits into longest-lived electrical wires and cables. Write for it to The Okonite Company, Passaic, New Jersey.



with today's installation costs* only the *Longest-Lived* will be economical

* The lifetime cost of a cable rather than its first cost is the only true measure. Okonite wires and cables, built to stand up better and longer, can offset high installation costs.

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THE BEST CABLE IS YOUR BEST POLICY

APRIL 24, 1948

"... Nobly Gain Or Meanly Lose ..."

"THIS GENERATION of Americans can nobly gain or meanly lose the hope of the world," former State Secretary James F. Byrnes declared late in the war. "If America can use her productive powers for peace as she uses them for war, we shall nobly gain that hope. If America can not use her productive powers for peace, America and the whole world will lose . . . It is not a theory to be held, but a condition to be met."

When he finished quoting these words to the Edison Electric Institute's annual sales meeting in Chicago recently, President Charles E. Wilson, of the General Electric Co added, quite simply:

"He was talking about us."

Just as if the electric power industry, however owned, hasn't got problems enough stateside, an acknowledged leader of the entire electrical industry used his Chicago appearance to pose another bewildering situation. Among other things, he made the point that America is part of the world and that America's industry will have to lead that world toward the better life for which it has always struggled. And American industry, Wilson went on, can't begin to do so without a superbly strong and flourishing electric power industry. The last war, if nothing else, proved this.

But just before he sounded this trumpet call, Wilson made another point. "We cannot help but note," he said, "that capacity is lacking to meet normal load growth—and our real worry is that the normal RATE of growth may become curtailed . . . we will not accept the view that promotion of power must depend on availability of excess capacity. The pioneers did not build the business that way and this is not the time to start."

Wilson referred at that point to the vast curtailment of plant expansion which utility leaders made in the depression. Today's hindsight—which, along with electric service, is about the only thing left which is at all inexpensive—shows how wrong it was so to curtail. For the industry has never quite recovered what it lost then. Just think of the intervening 16 years. More depression, a short boom, recession, defense, war, strikes and material shortages and then the greatest load growth in history. The industry is still trying to catch up with a situation which it did not make but which only it can remedy. When will it succeed? That's a question more easily answered last year than this.

It was shocking, last year, when GE officials told ELECTRICAL WORLD of their concern lest a business slump bring order cancellations. It is even more shocking to hear this repeated today. We can't imagine that the power industry has any such ideas. But we doubt that Wilson repeated this point just for the fun of it.

If there be any such sentiment, the industry's first job is to junk it. Does this industry want to go into a new war with a capacity situation such as it will have during the next four years? Does it want to power the world peace on the same basis? It's evident that the U. S. power industry will have to power either one or the other. Whichever it be, the job will take more plant, not less.

Helpful or Harmful?

NORTH DAKOTA'S Republican Senator Langer is counted a staunch friend of the Rural Electrification Administration. His friends in REA, thus, may be more embarrassed by a bill he introduced recently than they would have been had its sponsorship been different.

Among other things, Langer's bill boosts the amortization period for REA loans to 50 years. This device may become necessary as REA penetrates ever-thinner territory and hews to its requirement that all loans be self-liquidating, with interest. But another provision would permit the cancellation of unpaid interest and principal on such loans, at maturity, should the REA administrator conclude that the borrower can't repay. It is this provision which may trouble REA people.

It may trouble them for two reasons. For one thing, REA has long made the proud assertion that it is in no sense a subsidized program. Repayments by co-ops have been one of the most telling arguments REA has carried to Congress each year in search of new loan funds. Langer's amendment could easily change this record. It could do so by casting a doubt as to ultimate repayment where the record today denies any doubt. It could do so by encouraging borrowing beyond the reasonable expectation of ability to pay.

The other reason Langer's amendment may trouble REA lies in existing law. That requires REA's administrator to refuse a loan unless he is reasonably satisfied it can be paid off. Were Langer's proposal to become law, would not some future REA administrator be in a position easily to write off ancient loans as unpayable? The administrator 50 years from now will not have made any of the loans he may find unpaid at expiration. Will not today's administrators be under less pressure to make self-liquidating loans only? Without implying that Langer's amendment would automatically bring abuse, either today or 50 years hence, this possibility would be much more real. And the very existence of any such possibility could only harm REA's operations today.

Public Relations' "New Look"

"AMERICAN BUSINESS and industry will spend more than ever before this year on public relations," says a weekly "letter" on the desk. It adds that:

". . . one (expert) says the essence of good public relations is to 'make your boss get up on his hind legs and say the same things in public he says in private.' "

To this good-hearted intelligence we have two reactions. In order, they are

1. Just a few short years ago, the way we heard it, the essence of good public relations was "for crying out loud, get the boss to be quiet." How times have changed.

2. Privately owned electric utilities have a public relations problem, too. Perhaps theirs is a double problem. One part of it is that concerning the way of life which has made this country great. This is a problem which is occupying many of management's better minds, this season.

Inescapably, the other part of the utility problem is the future of the electric utility business. Electric utilities think some changes should be made in national power policy. So do we. These changes will have to be made by the Congress and approved by the executive. Ultimately, both the legislator and the executive will either abide by public opinion or answer to it. So one of the aspects of success in Washington is success back home—where and when the public makes up its mind on such issues as power policy.

Regardless of just how it be approached or influenced, this making-up-of-the-public's-mind is part of the electric utilities' public relations problem. Whether it be through sparkling services, or rate cuts, or advertising, or any other means of influencing public opinion, the electric utilities who would re-make power policy have a job to do. They must convince the public that such change is in the public interest.

No Help From TVA

NOT LONG AGO, we indicated editorially the belief that TVA had organized the Distributors' Information Committee of the Tennessee Valley Public Power Association. A committee official hastens to tell us it isn't so. TVA, he says, had no part in organizing either the Information Committee or its parent, the TVPPA. He says it's utterly without foundation and a reflection on the business-managed, tax-paying, publicly owned distribution systems of the area.

Try Again, Mr. Truman

WITH HIS appointment of Thomas C. Buchanan to the Federal Power Commission, President Truman has opened the third round for that divided agency. At the outset, this third-round negotiation doesn't look as if it's going to get anyone much of a raise.

It doesn't look like a raise for Buchanan because it doesn't look a bit like he'll be confirmed. For one thing, GOP Congressional leaders have been saying they see small point in confirming nominations which will be theirs after November. And Buchanan was refused reappointment to the Pennsylvania Commission some years back by Gov Edward Martin, now U. S. Senator from Pennsylvania.

It doesn't look like a gain for FPC to have a continuation of the vacancy which has plagued it so long. Nor does another Congressional fight, such as a vote on Buchanan would inevitably mean, look good, either from the viewpoint of a busy regulatory commission.

For the power and gas industries, it isn't a raise to have named to FPC a man who automatically believes that utilities are wrong. And that was the Buchanan record in Pennsylvania.

NEWS OF THE ELECTRICAL WORLD

The Electrical Week

The National Association of Electric Companies is pursuing its work on tax problems. Detroit Chairman Prentiss Brown told NAEC that a "thorough-going tax study is needed" . . . In the Senate, a move was defeated to extend Reclamation Bureau work into Arkansas . . . Load-capacity problems engrossed a recent meeting of the Northwest EL&P Association, which is asking federal funds for Columbia power . . . Wisconsin utilities are expanding with private financing—$60,000,000 this year . . . And there's no joy in South Carolina, Santee-Cooper has struck out in an attempt to halt a sale to a private system.

. . .

Strange As It Seems Dept: New Orleans has a utility rate fight which finds one cab company threatening to sue the city if it OK's a fare boost.

. . .

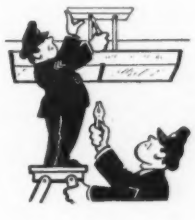
French industrial production is rising rapidly. In February, it was 12% higher than during an average month of 1938.

. . .

Pittsburgh's anti-smoke ordinance isn't yet fully effective, but it's working. There hasn't been a "50,000-kw cloud" since it took effect last Oct 1.

. . .

Electrical contractors in Lexington, Ky., have complained to the City Commission about the policemen. The bluecoats are doing electrical contracting in their spare time and doing it cheaper. The contractors want a license law to stop the practice.



. . .

During World War I, uranium was discarded as a useless byproduct of radium.

. . .

Washington's Public Service Commission denied a rate plea by a Puget Sound ferry company, forced it out of business. Now the state proposes to enter the ferry business.

Electrical retailers and contractors in Milwaukee have been waging—and publicizing—a vigorous fight. Primarily, it concerns charges for range wiring. The feeling is that no one is winning.

. . .

One Midwestern system sees numerous minor evidences of an existing, mild recession. But the "exceptional" prosperity of its rural areas forestalls any real worry about business. A recent survey in one of its counties showed industrial workers with average annual earnings of $2,850. Per farm, the corresponding figure was more than $7,600.

. . .

Power supply in California seems to be a feast or a famine business. Recently the state was worse off than any place ever was during the war. By the end of this year, enough steam will have been added to make PG&E go looking for load.

. . .

Operating and maintenance men are under increasing pressure to cut costs. After financing, this is management's big worry now. But over the short term at least, the efficiencies of new plants are expected to be a huge help.

. . .

A manufacturer who has stopped shipping motors to Russia was asked, "Did you stop of your accord?" He danced around the Maypole for five minutes and concluded with, "I think you could say we stopped of our own accord."

. . .

Industrial customers were "swell," says a top official of one system which recently got into a tight capacity situation through water shortage and delayed plant. In addition to curtailing as requested, the industrials put on the line all the equipment they could possibly operate, and without any argument as to price, etc.

. . .

Slow deliveries of porcelain, copperweld and aluminum have some utilities planning transmission additions three years ahead. Steel for cores is the delaying factor.

Prentiss Brown Calls for Reform in Tax Structure at NAEC Meeting

A "THOROUGH-GOING, fundamental, authoritative study" of all taxes—federal, state and local—has become a pressing national need, one of especial importance to the business world.

And only such an investigation can lead to fair and equitable reform of our tax structure, according to Prentiss M. Brown, chairman of the board of the Detroit Edison Co. The former U. S. Senator from Michigan, speaking at the annual meeting of the National Association of Electric Companies last week in Washington, urged immediate consideration by the Congress of such a tax conference.

Taxes were "reasonably fair and just" prior to 1920, he asserted. But increasing federal taxes, resulting from war and other crises, upset the balance of the tax structure.

"These great obligations caused the federal government to reach out into almost all fields of taxes other than real and personal property taxes, which in most states are left to the local governments," Smith said. "That the federal government has enroached heavily on fields that should be left to local and state governments is obvious."

His solution—a conference of representatives of all taxing authorities, with spokesmen for the taxpayers taking part, to institute needed reforms—"probably would take years," he conceded. The effort should be backed by Congress with the enactment of legislation to give the conference legal status.

Listing a number of "tax injustices," he pointed first to the tax exemption enjoyed by municipal and state bonds. No "fair comparision" of public and privately financed utility rates can be made "as long as there is a total exemption of municipal plants from taxation," he added.

At NAEC's business sessions, Purcell L. Smith, president, and A. C. Spurr, vice-president, were reelected to those offices. Arthur R. Barnett, secretary, was reelected and also named treasurer. New directors include: George R. Conover, Philadelphia Electric Co; C. S. Hammond, Georgia Power Co; R. K. Lane, Public Service Co of Oklahoma; A. M. Sells, Wisconsin Electric Power Co; E. H. Werner, Jersey Central Power & Light Co, and T. E. Roach, Idaho Power Co.

•

8 GI Trainees Included in IBEW Bargaining Unit

Eight GI trainees employed by the Electrical Equipment Co in its Richmond (Va) plant have been included in an IBEW collective bargaining unit over the objections of the company.

The National Labor Relations Board found that the trainees, employed in electrical equipment repair work under an arrangement with the Veteran's Administration, had a sufficient interest in the jobs to warrant their inclusion in a bargaining unit of all repair service personnel. Whether the workers in this unit wish to be represented by the IBEW will be decided at an election before the end of April.

FOR OPERATING 15 YEARS without a single disabling accident, the Amesbury (Mass.) Electric Light Co has received the Edison Electric Institute Meritorious Service Award. The company's 40 employees worked 1,002,984 manhours from 1933 to 1948 to set the record. Left to right are F. G. Harriman, safety manager, New England Electric System; Guy E. Nickerson, vice-president of the utility; E. C. Rue, chairman of EEI's Safety Committee; and L. E. Seekins, president of the utility

Water Going to Waste at Shasta as Snows Melt

Melting snows in Northern California watersheds last week filled Shasta Reservoir to record heights, forcing Reclamation officials to spill some 8,000 sec ft on Apr 17 and 18 to maintain the dam's flood control function.

Water storage behind the dam reached 3,584 acre ft, leaving only about 150,000 acre ft of flood control space in the 3,700,000 acre ft reservoir.

Water was wasted through dam outlets beyond that usable for power generation and irrigation in spite of the energizing of a third 75,000 kw generator Apr 15. The new generator permitted total generation at the dam of 247,000 kw, 22,000 kw over capacity.

A fourth generator, the second of two machines lent during the war to Grand Coulee, is scheduled to go into operation this summer.

The Bureau of Reclamation, through Regional Director Richard Boke, formally offered delivery of power from the third generator to Pacific Gas & Electric Co on a day-to-day basis, temporarily settling the controversy over delivery terms. Earlier in the week, the Bureau had said that no agreement had been reached on terms of sale. This statement was contrary to a previous California Public Utilities Commission announcement.

However, Boke declared there would be no renewal of the contract for firm power, which expires at the end of the year, until PG&E agrees to wheel power to public agencies.

•

Russians Accept Steiger as Magidoff Successor

Andrew J. Steiger has been officially accredited by the Russian Foreign Office as head of the McGraw-Hill World News Bureau in Moscow. Steiger has been assistant to Robert Magidoff who last week was expelled from the Soviet Union on charges of espionage. Magidoff was McGraw-Hill World News representative in Moscow since 1945. His work included the gathering of news and the preparation of technical articles. Magidoff's stories have appeared in all 35 McGraw-Hill publications including ELECTRICAL WORLD.

The espionage charge was based on a routine news assignment made nearly a year ago. The assignment was given a number of World News correspondents. It was to determine the effectiveness of underground plants during the recent war. Though a number of correspondents have completed their assignment, Magidoff has never been able to gather information for such an article.

Starting of Reclamation Projects in Arkansas Delayed by Senate

THE SENATE last week blocked prospects of the starting of federal Reclamation projects in Arkansas for at least another year. That was the apparent effect of the tabling of legislation introduced by Arkansas Senators McClellan and Fulbright, both Democrats.

Bills extending coverage of federal reclamation laws to Arkansas were approved by both House and Senate committees last May and have been on the calendars of both bodies ever since. They had previously stirred little attention, but last week's Senate debate on the McClellan-Fulbright bill approached the proportions of a filibuster.

Senators Downey of California and Overton of Louisiana, Democrats, led the opposition. Downey reiterated charges that he has made on several earlier occasions to the effect that the Bureau of Reclamation has engaged in propaganda and other improper activities. He attacked top administration of the Bureau and demanded that its authority not be extended until this leadership has been changed.

Overton pointed out that the Army Engineers already are working on flood control and other river projects in Arkansas. Reclamation Bureau operations in the same state would lead to unprofitable bickering between the two agencies, he asserted.

Senator Fulbright was assisted in the defense of his bill by Senators Watkins, Utah Republican, and Chavez, Democrat, of New Mexico. They made no reply to the charges leveled at the Reclamation Bureau leadership. But they contended that even if these attacks were true they should constitute no grounds for preventing Reclamation work in Arkansas.

After portions of two days had been consumed in debate, the Senate agreed to return the measure to the calendar in order to take up other business. This means the bill cannot be debated again in the near future without unanimous consent. There is little likelihood that it will come up on the calendar before the end of this session.

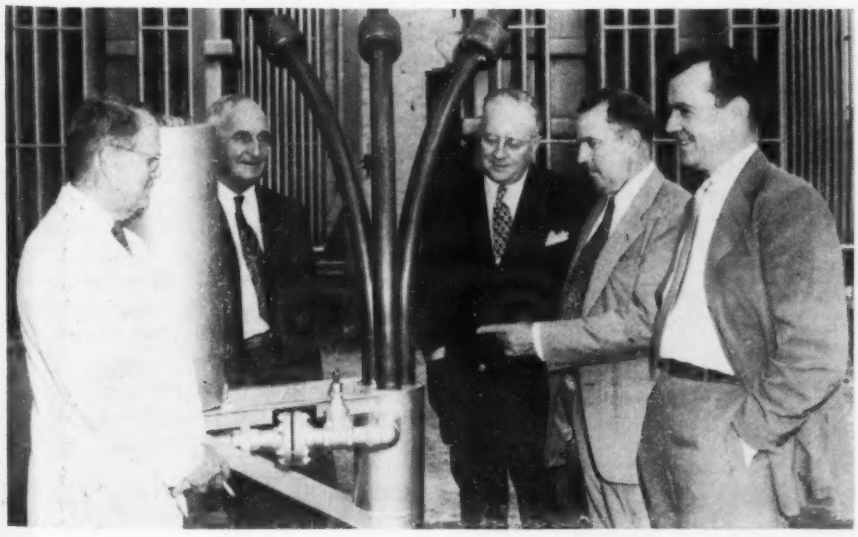
House action on an identical bill seems similarly stalled.

•

Florida P&L Energizes 69-Kv Underground Cable

The new 69-kv compression type cable, which connects the Miami plant and the Coconut Grove substation, has been energized by Florida Power & Light Co. This 4.84-mi cable, rated at 50,000 kva, was installed at a cost of more than $550,000. It is the first of its kind in Florida.

Supplied by Phelps Dodge Copper Products Co, this paper-insulated cable, with copper shield tapes and polyethylene sheath, has oil as the compression medium. Conductors are 400,000 cir mil. The cable is installed in a 5-in. welded steel pipe, supplied in random 40-ft lengths with somastic coating.



McGREGOR SMITH, president, Florida Power & Light Co, points out features of the 69-kv underground cable installation. Left to right, J. H. White, vice-president in charge of operation for FP&L; Verne Clawson, construction superintendent of Ebasco Services; H. T. Brinton, executive vice-president, Phelps Dodge Copper Products Corp; Smith; and E. P. Dunleavy, Phelps Dodge sales manager for copper cables

Buchanan Named to FPC; Wimberly Reappointed

Another round—but not the last—of the battle over the vacancy on the Federal Power Commission went merrily on this week as a Senate Committee found itself studying not one, but two, nominations.

This development followed an apparent compromise by the White House last week when Thomas Chalmers Buchanan was appointed to fill the existing vacancy and Commissioner Harrington Wimberly was reappointed. The latter's present term expires in June. Both are Democrats. The Interstate and Foreign Commerce Committee will take up the nominations on Apr 29.

Buchanan, a Beaver, Pa., attorney, is the second presidential appointee to the vacancy created early last year by the resignation of Commissioner Richard Sachse. Burton N. Behling, a member of FPC's natural gas investigation staff, was appointed shortly after the Sachse resignation and reappointed in January. The Behling nomination was withdrawn a few weeks ago, presumably because of a protest by Sen Joseph O'Mahoney.

O'Mahoney Blasts Behling

In a letter to the President, the Wyoming Democrat blasted Behling for his testimony in behalf of proposed amendments of the Natural Gas Act. These proposals were submitted to a Senate committee by FPC Chairman Smith and Commissioner Wimberly. They were opposed by Commissioners Olds and Draper.

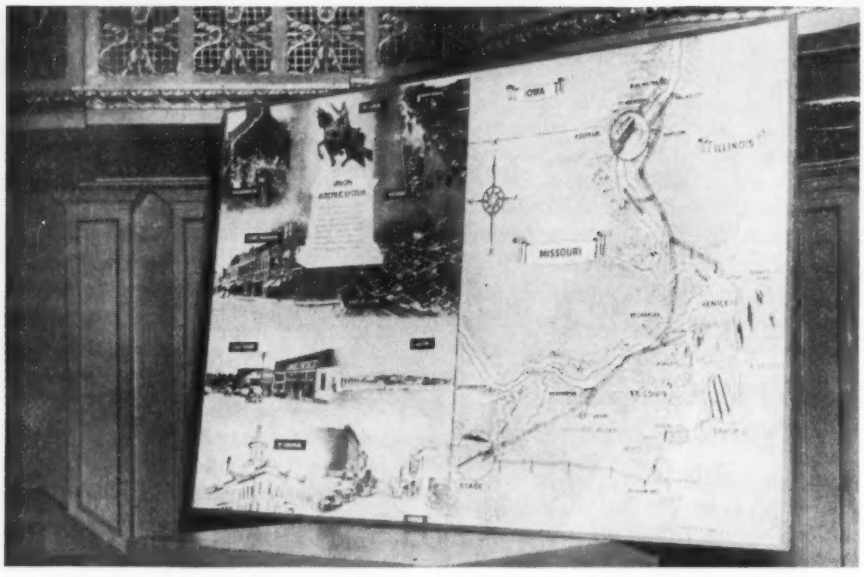
Senator O'Mahoney, like Olds and Draper, charged that the suggested amendments would affect considerable increases in natural gas rates to the ultimate consumer. He hinted that he would oppose the renomination of Commissioner Wimberly because of the latter's support of the proposals.

Myers Recommends Buchanan

Buchanan was recommended by Sen Francis J. Myers, Pennsylvania Democrat. Though he had made no public statement, O'Mahoney was reported as favoring the Buchanan appointment and "not thinking of opposing" Wimberly.

The 53-year old Buchanan is a graduate of Washington and Jefferson College and University of Pittsburgh's Law School. In 1936, he was appointed by Governor George Earle to the Pennsylvania Public Utilities Commission, on which he served for eight years. As a member of that body, he was extremely active in utility rate cases, gaining a reputation as an ardent advocate of the original cost method of accounting. An

EXECUTIVES of Union Electric Co of Missouri assembled to tell the company's 1947 accomplishments to supervisory employees



REPRODUCTION of 1947 Annual Report used at meeting of supervisory employees

associate of Commissioner Olds, he testified in the latter's behalf during 1944 Senate hearings on Olds' appointment to FPC.

Commissioner Wimberly, who last year was reported ready to quit the FPC, told ELECTRICAL WORLD that he would "serve if confirmed" by the Senate.

•

Electric Utilities' Revenues Rose 12.1%, FPC Reports

Electric operating revenues of the larger privately owned electric utilities in the United States amounted to $3,689,594,000 in 1947, compared to $3,292,696,000 in 1946, the Federal Power Commission has announced. This is an increase of 12.1%. The increase in revenues, however, was almost entirely absorbed by an increase in combined operating expenses, taxes and depreciation charges from $2,529,009,000 in 1946 to $2,925,829,000 in 1947.

The largest increase in revenues came from service to industrial users. Revenues from such service amounted to $1,054,004,000 in 1947, up 13.8% over 1946. Revenues from residential service were $1,093,510,000 and from commercial service $836,145,000, representing increases of 8.3% and 12.0% respectively over 1946.

Net Revenues of Ft Peck in 1947 Were $204,968

Net operating revenues for the Fort Peck power project on the Missouri River in Montana for fiscal 1947 were $204,968.40. This was disclosed in the recent report made to Congress by the Bureau of Reclamation which markets the energy.

The hydro plant (35,000-kw) generated 204,347,000 kwhr, an auxiliary diesel, 16,400 kwhr. Total energy sales brought in a revenue of $524,282.36, and system expenses were $319,313.96. The revenues included that from sales of 781,300 kwhr purchased from the Montana Power Co and the 299,425 kwhr purchased from the Montana-Dakota Utilities Co.

The two utilities were Fort Peck's best customers. Montana Power bought 130,058,160 kwhr for $325,145.40, and Montana-Dakota, 44,994,450 kwhr for $175,464.32.

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Utilities Bills Taxed

Vero Beach, Fla., has placed a tax on all bills for utilities services. The rate is 10% on the first $50, decreasing to 5% on the next $100 and to 1% after that.

Union Electric Co Show Reveals 1947 Activities

To acquaint its supervisory personnel with company activities during 1947 and with plans for the future, Union Electric Co of Missouri recently presented a show. Over 700 persons attended.

The 68-minute show was presented in this way:

President J. W. McAfee and eight other top Union Electric officials sat behind a long table in the ballroom of St. Louis' Hotel Jefferson. Behind the table was a large screen for photo and chart slides and motion pictures. To the right of the stage was an 8 by 10 ft reproduction of the 1947 Annual Report cover and a few key inside pages. To the left was a system map.

As each official spoke, appropriate charts and photos flashed on the screen, or a spotlight focused attention on the enlarged Annual Report. Speeches were limited to seven minutes.

•

12th CIGRE Conference to Open in Paris, June 24

The International Conference on Large Electric High-Tension Systems (CIGRE) will hold its twelfth congress, June 24 to July 3, at Paris. The conference was founded in 1921 and has over 1,000 permanent members and 2,000 corresponding members in over 40 countries.

Objects of the conference are to discover and diffuse knowledge of the progress in the technique of large high tension electric systems. Meetings are held every two years. Manufacturers, contractors, power distributors, professors, and private and government engineers are among the members.

A number of Americans will present papers at the Paris conference. Sessions will be conducted in English, French, and Russian.

Officers of the U. S. National Committee are: chairman, Frederic Attwood, vice-president, Ohio Brass Co; vice-chairman, John C. Parker, vice-president, Consolidated Edison Co; and secretary-treasurer. I. W. Gross, American Gas & Electric Service Corp, 30 Church St, New York 8, N. Y.

Problems of Coping with Anticipated Northwest Power Shortage Studied

PROBLEMS OF COPING with an expected power deficiency in the Northwest power pool during 1948-49 were important topics of discussion at the Engineering Section meeting of the Northwest Electric Light & Power Association at Spokane, Apr 14-16.

J. E. E. Royer, vice-president, Washington Water Power Co, told of efforts by all Northwest power suppliers and the general public to impress Congress with the necessity for large appropriations to step-up construction schedules on authorized federal projects on the Columbia River.

E. N. Peterson, of the coordinating committee of the Northwest power pool, said latest forecasts definitely indicate a peaking deficiency, the amount depending upon water conditions and fuel availability. This could create a 200,000 kw deficiency on an expected peak of over 4,000,000 kw if water conditions are "average." This condition represented a 75% probability factor. Energy deficiency under the same conditions would be 90,000 kw. Under near-ideal conditions the load could be carried without too much inconvenience to the public. But the probability that such ideal conditions will occur are so remote that this view cannot be realistically taken.

Causes of cavitation in hydraulic turbines were shown by William J. Rheingans, Allis-Chalmers Manufacturing Co, in a motion picture film taken at 20,000 frames per second. Contrary to popular belief, cavitation is not due to chemical action from release of free hydrogen. It is purely a mechanical action from the formation and collapse of air bubbles producing mechanical hammering up to 50,000 psi.

Lower velocities, higher pressures, and resistant materials are remedies. Economy is limiting factor in lowering turbines to reduce back-pressure. Stainless steel has been found most resistant to cavitation and is now widely used in repairs and as an overlay on cast steel in new runners at points of cavitation. It is also the best answer to erosion and corrosion.

A new inhibited transformer oil with expected life of three to five times that of conventional oils was described by Dr R. C. Larsen of Shell Development Co. Field tests by several large utilities have confirmed accelerated laboratory results, he said, as to the oil's non-oxidizing, non-sludging, and long-life properties.

J. R. Conrad, S & C Electric Co, Chicago, presented latest developments in fuse link design, radically affecting their application and performance. His company has developed a new material known as Arctrol which is incorporated in the fuse link as an assist in finally making cut-out performance satisfactory on low fault currents. He pointed out the importance of effectively clearing low fault currents as an essential to securing secondary short circuit protection in current-day primary fusing practice for distribution transformers. Arctrol is used in the link sheath to replace paper or fibre. Very recent tests announced for the first time showed completely successful fault current interruption on 13.2-kv circuits at 32 amp in an open link fuse with a reduction in arcing time to three-quarters of a cycle.

A new electronic device, working on the radar principle, for locating faults on transmission lines was described by A. A. Noon, Puget Sound Power & Light Co. Field tests indicate reliability and great promise. Micro waves are sent out and length of time for their return is calibrated in miles of line of the fault.

Lester R. Gamble, Washington Water Power Co, and John Bankus, Portland General Electric Co, were re-elected chairman and vice-chairman respectively of the Engineering Section for another year.

EEI Farm Electrification Statistics

(Figures are as of Dec. 31, 1947)

Of the 5,859,169 farms in the United States, 3,817,100 or 65.1% are electrified. This compares with 2,929,000 or 50% at the end of 1945.

In 13 states, over 90% of the farms are electrified.

Percentagewise, Connecticut leads the nation with 21,600 or 97.1% of its 22,241 farms electrified. It is followed by Vermont with 25,700 out of 26,490 or 97% and Washington with 76,800 out of 79,887 or 96.1%.

The three bottom states are North Dakota with 12,200 or 17.5% of its 69,520 farms electrified. In order, come South Dakota with 13,000 or 18.9% of 68,705 farms and Mississippi with 95,400 or 36.2% of 263,528 farms.

In numbers, Texas, which has the most farms, 384,977, has the most electrified, 257,100 or 66.8%. Nevada, which has the fewest, 3,429 has the fewest electrified, 1,900 or 55.4%.

Grand River Authority Buys Oklahoma Plant

The War Assets Administration has approved sale of the power plant and water system at the Oklahoma Ordnance Works, near Choteau, Okla., to the Grand River Dam Authority for $3,500,000, the appraised fair value. The transfer is subject to operation of the National Security Clause in event of a national emergency.

The Authority, an agency of the State of Oklahoma, was a priority bidder. The facilities will be integrated with the Grand River electric system which serves areas in Oklahoma, Arkansas, Missouri, and Kansas. The Authority, which expects to take immediate possession, will use the steam plant to firm up the output of the plant at Pensacola Dam and develop a maximum amount of electric energy.

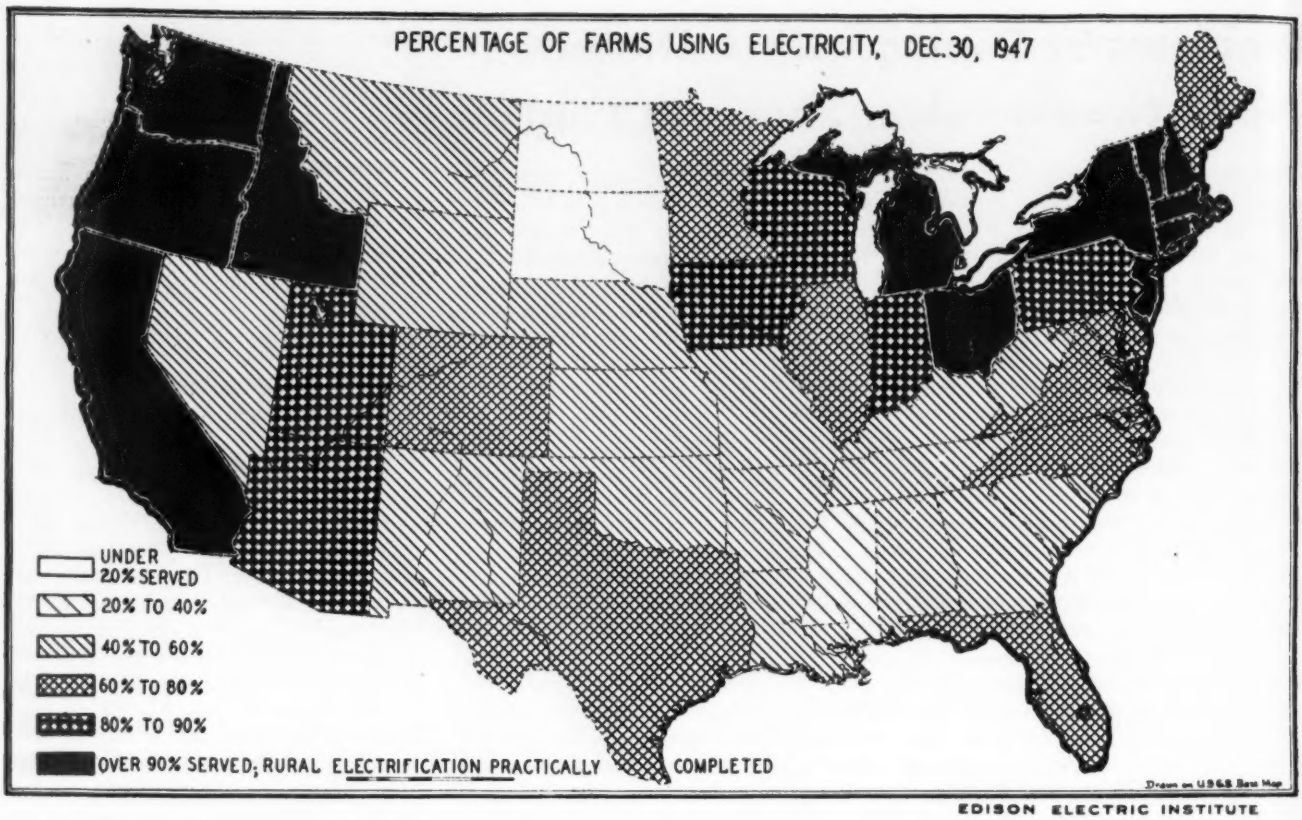
Public Service Co of Oklahoma was interested also in acquiring the plant which has four units with a total capacity of 20,000 kw. The utility reportedly bid about $1,000,000 less than the GRDA. After the bids were announced, Public Service submitted a new bid of $3,600,000 (EW, Dec 6, 1947, Page 73). This bid was not accepted.

Salt River Association, IBEW to Continue Pact

Pending changes in the present critical financial position of the Salt River Valley Water Users' Association, the Association and the International Brotherhood of Electrical Workers, AFL, have agreed to continue their contract.

Both sides agreed that should rains fill Association reservoirs or the Association's financial status improve in any manner, wage negotiations will be reopened.

The union has asked for an increase of 22 cents an hour across the board. The appeal, filed in February, was rejected by the Association on grounds the increase was prohibitive because drought conditions have magnified generating costs.


PERCENTAGE OF FARMS USING ELECTRICITY, DEC. 30, 1947
UNDER 20% SERVED
20% TO 40%
40% TO 60%
60% TO 80%
80% TO 90%
OVER 90% SERVED; RURAL ELECTRIFICATION PRACTICALLY COMPLETED

EDISON ELECTRIC INSTITUTE

South Carolina Authority Loses Plea to SEC to Halt Sale of Private Utility

THE EXPANSION-MINDED South Carolina Public Service Authority this week lost one battle to extend its operations and appeared ready to plunge right into another.

The Securities and Exchange Commission denied an appeal by the state agency to reopen its consideration of the sale of the South Carolina Power Co to South Carolina Electric & Gas Co. SEC approved the latter deal on Mar. 25.

At about the same time, SEC was denying the authority's rehearing plea —Apr 19—representatives of Rural Electric Cooperatives came to Washington seeking funds to transmit Santee-Cooper Power throughout the state.

The Public Service Authority had contended before SEC that it wished to purchase the South Carolina Power system in order to serve rural co-ops and other would-be consumers of energy from its Santee-Cooper plant.

The Authority's petition to SEC for rehearing contended that there was a "strong probability" that "another private bidder" would be willing to make a "more favorable" offer for the SCP property than that of Electric & Gas. This prospective bidder, it was reported, would "work on an interim basis" with the Authority until the state courts resolved the question of the agency's legal right to buy the property. This legal question was considered by SEC in its original refusal to set aside the Gas & Electric purchase offer in favor of that made by the state body.

SEC ruled that evidence of the prospective new bid was so "vague and indefinite" as to afford "insufficient assurance" of bettering the Electric & Gas proposal. The Commission pointed out that failure of the Authority's scheme would leave Commonwealth & Southern Corp, holder of SCP's common stock, with "weakened prospects" of a satisfactory sale price.

Details of the co-op plan to transmit Santee-Cooper energy were not available, though Rural Electrification Administration officials admitted they had been "approached" in the matter. Apparently, the sponsors hope to set up a state-wide transmission co-op, financed by REA and serving all rural distribution co-ops in South Carolina. How many distribution co-ops were interested in the project was not revealed.

•

Power Restrictions Lifted

Improved water conditions have led to the lifting of all power restrictions in Southern Ontario.

GE Cuts Prices on Some Apparatus by 5% on Apr 16

General Electric Co as of Apr 16 reduced by 5% the price of certain lines of Apparatus Department products.

Products affected are fractional-hp motors, switchgear, conventional distribution transformers, lightning arresters, feeder regulators, cutouts, and power capacitors.

This was the second price reduction this year. On Jan 1, GE announced a 3 to 10% reduction on a broad line of appliances and small electrical equipment. Also last December, the Apparatus Department adopted a policy of "price prevailing at time of shipment." This policy still prevails so that a substantial amount of business already booked will benefit from the reduction.

President Charles E. Wilson said that GE expects to maintain the reduced prices "provided no further increase occurs in our own labor costs or in prices of components and materials which we purchase in so great a measure from others."

•

Rice Elected to PSC

Charles A. Rice, Greenville, has been unanimously elected by the General Assembly to succeed James W. Wolfe as a member of the South Carolina Public Service Commission. Wolfe, a member of the commission since March, 1934, has resigned to practice law.

10 Wisconsin Utilities Will Spend $60 Million for 1948 Construction

To SUPPLY the tremendously increasing demand for electric service in Wisconsin and to overtake war-deferred expansion, the state's ten largest electric companies will invest $60.275,725 during 1948. The money will be used for construction to improve, expand, and maintain their production and distribution facilities. That information was disclosed by a survey made by A. F. Herwig, Milwaukee, executive secretary of the Wisconsin Utilities Association.

Major projects and budgets include:

Wisconsin Electric Power Co—Budget, $20.825,106. Major items: construction of Units No. 3 and No. 4 at Port Washington Plant; 132-kv transmission line, Port Washington to Milwaukee; new substations; increased capacity at existing substations; 132-kv transmission line from Kenosha to Milwaukee; electric distribution headquarters building.

Wisconsin Public Service Corp and subsidiary—Budget, $14,154,000. Major items: three 100-kw diesel generating units at Rhinelander; one 50,000-kw steam turbo-generating unit addition at Bayside plant at Green Bay; 138-kv transmission line from Green Bay to Oshkosh and substation; 115-kv transmission line from Green Bay to Wausau and substation; 115-kv transmission line from Stevens Point to Petenwell and substation; 69-kv transmission line from Merrill to Antigo and substation; 69-kv transmission line from Peshtigo to Oconto and substation; storeroom building at Green Bay; and office remodeling at Oshkosh.

Northern States Power Co — Budget, $9,480,000. Major item: hydro plant development at Holcombe.

Wisconsin Power & Light Co—Budget, $7,404,531. Major items: second 25,000-kw addition to Blackhawk steam plant at Beloit; 22 miles of 69-kv transmission line from Beloit to Walworth; 12 miles of 34.5-kv transmission line from Stoughton to Oregon; 16 miles of 34.5-kv transmission line from Ripon to Omro.

Wisconsin Michigan Power Co — Budget, $3,028,778. Major items: urban and rural line extensions; reconstruction of 33-kv transmission loop affecting 19¼ miles of line; additions to various transmission and distribution substations; one 1,500-kva substation at Neenah; one 1,500-kva substation at Appleton; construction of a 16,000-kw hydro generating station at Quinnesec Falls on the Menominee River near Iron Mountain, Mich.

Madison Gas & Electric Co—Budget, $2,977,058. Major items: addition to Blount Street Station of 20,000-kw turbo unit; additional high pressure boiler; fly ash precipitator; 2,000-kva unit type substation; 13.2-kv supply circuit to substation.

Wisconsin Gas & Electric Co—Budget, $2,111,000. Major items: Completion of 51.89 miles of transmission lines, construction of new substations, improvements to present substations, including increased capacity, reconstruction of street lighting system.

Lake Superior District Power Co — Budget, $1,540,787.74. Major items: Bay Front steam plant additions; construction of 35 miles of 33.5-kv transmission line; construction of 2,200-kw diesel generating plants at Athens and at Hayward.

Wisconsin Hydro-Electric Co—Budget, $695,260.49. Major items: diesel engine at Eau Galle plant; diesel engine at Clear Lake plant; new diesel plant at Chetek, two engine units.

Superior Water, Light & Power Co—Budget, $161,546. Major items: electric plant improvements, general extensions, meters, transformers, substation, street lighting.

OIL FROM VENEZUELA arrives at the Hell Gate Station of Consolidated Edison Co of New York. The 4,000,000-gal shipment was the first importation of fuel oil by the utility. The oil was sufficient to operate the station for a week

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International Takes Over IBEW Local at Seattle

International officers of the International Brotherhood of Electrical Workers, AFL, have taken over administration of Local 77 at Seattle, Wash. Membership is composed of 5,500 linemen, cable splicers, maintenance men, and others throughout Washington.

Henry W. Newcombe, international representative of the union from the North district, acting for the international, requested and received the resignations of the local's officers but reappointed some of them.

There has been dissension in the union since outdoor workers conducted an unauthorized strike against the Puget Sound Power & Light Co. Union officials had declined to support the demands of outdoor workers for higher wage increases than other workers. The outdoor workers contended they were entitled to more money because of the bazards encountered in their work.

•

3 Connecticut Utilities Acquire Steam Plant Site

Three Connecticut utilities have acquired a site at Waterford for a steam electric generating plant. The utilities are the Hartford Electric Light Co, Connecticut Light & Power Co, and the Connecticut Power Co. The size of the plant, which is to be developed jointly, and the date of construction have not been decided.

The 114-acre plot is on the shore of Long Island Sound at the eastern entrance of Niantic Bay. The site offers year-round water-borne fuel delivery and ample condensing water. Rail facilities are available also.

•

80,000-Kw Industrial Plant

Electro Metallurgical Co, Ashtabula, Ohio, has under construction an 80,000-kw steam electric generating plant.

American Power Files Assets Distribution Plan

American Power & Light Co has filed with the Securities and Exchange Commission a plan for the distribution of its assets to its preferred and common stockholders. Under the plan, American's holdings of common stock of most of its subsidiaries would be distributed directly to its stockholders. The preferred and common stocks of American, representing its remaining assets, would be reclassified into a new single class of stock.

Electric Bond & Share Co, American's parent, agreed to the plan with one exception. On the allocation of securities, Bond & Share proposes that 21% of the total go to common holders and 79% to the $6 and $5 preferred holders. American suggests 16% and 84% respectively. Bond & Share owns 31% of American's common and 5% of the $5 preferred.

American has outstanding 793,581 shares of $6 preferred, 978,444 shares of $5 preferred, and 3,008,511 shares of common. Unpaid accumulated dividend arrears on the preferred stocks total $70,109,255.

The subsidiary common stocks to be distributed to American's stockholders are those of Florida Power & Light Co, Kansas Gas & Electric Co, Minnesota Power & Light Co, Montana Power Co, and Texas Utilities Co. The latter is a subsidiary holding company for the common stocks of Dallas Power & Light Co, Texas Electric Service Co, and Texas Power & Light Co.

American would remain in existence, after reclassification of its stocks into a single class of stock, as a holding company for the common stocks of Washington Water Power Co and Pacific Power & Light Co. A plan to merge Pacific into Washington Water still lacks approval of state authorities. If the merger succeeds, common stock of Washington may also be distributed to American's stockholders. Then American would be dissolved.

•

Strike Ends at Tidd Plant

Strikers at Tidd Plant of Ohio Power Co returned to work at midnight, Apr 16. They had been out since the morning of Apr 12. They went back on the same terms offered before the strike. These were that the company would bargain with the UWU-CIO, but the inclusion of control operators in the bargaining unit is to be left for the courts to decide. The Local had been willing to accept these conditions, but national officers ordered the strike. Tidd Plant operated during the strike.

SEC RULINGS

Middle West Corp has received authorization to acquire 330,740 shares of common stock of Middle West Utilities Co of Canada, Ltd. This stock has a stated value of $3,796,080 and represents entire outstanding capital stock of the subsidiary. The stock will be acquired in exchange for Middle West's holdings of 6,600 shares of preference stock and 392,010 common shares of the subsidiary. As the result of a recent recapitalization, the subsidiary's preference and common stocks, all of which are owned by Middle West Corp, were reclassified into 438,730 shares of new common. (Release No. 8072).

West Texas Utilities Co, subsidiary of Central & South West Corp, has received authorization to sell 1,983 shares of its $6 preferred stock, without par value, now held in its treasury. The stock is to be sold locally through brokers, or directly to the public, at the prevailing market price but in no event less than $110 per share and accrued dividends. Purchasers are to be notified that the stock is subject to redemption at the company's option at $110 plus accrued dividends. The stock was reacquired by West Texas during the period 1935 through 1943. (Release No. 8093).

Texas Electric Service Co and its parent, Texas Utilities Co, which is a subsidiary of American Power & Light Co, received the green light from the SEC on their financing plans when the commission released jurisdiction with respect to competitive bidding and to fees and expenses of counsel. The program involved the issue and sale by Texas Electric of $5,000,000 principal amount of first mortgage bonds and of $5,000,000 of sinking fund debentures and the cash contribution by Texas Utilities to Texas Electric of $1,500,000, such amount to be added to the stated value of Texas Electric common stock. (Release No. 8092).

Arkansas Power & Light Co's sale of 320,000 additional shares of its common stock to its parent, Electric Power & Light Corp, for a cash consideration of $4,000,000 has received SEC clearance. Proceeds are to be used for the construction of new facilities and improvements by the Arkansas company. (Release No. 8094).

Long Island Lighting Co 7% and 6% preferred stockholders group has received authorization to solicit authorizations from the preferred stockholders of Long Island to represent them in proceedings before the commission upon that company's pending plan of reorganization. (Release No. 8077).

Electric Bond & Share Co has been permitted to pay $457,851 as fees and $292,772 in expenses in connection with the company's plan for retirement of its $5 and $6 preferred stocks and related transactions. (Release No. 8084).

American Light & Traction Co has received permission to sell at competitive bidding 450,000 shares of common stock of the Detroit Edison Co. Terms of the offering are to be filed by amendment. (Release No. 8125).

MEETINGS

PREVIOUSLY LISTED

Southeastern School Lighting Institute—Exhibit, Mirror Lake Junior High School, St. Petersburg, Fla., April 19-May 15.

American Institute of Electrical Engineers—North Eastern District Meeting, Taft Hotel, New Haven, Conn., April 28-30; Summer General Meeting, Palace of Fine Arts, Mexico City, Mex., June 21-25.

Missouri Association of Public Utilities—Annual Convention, Hotel Jefferson, St. Louis, April 28-30.

Edison Electric Institute—Engineering Committees, Edgewater Beach Hotel, Chicago, May 3-5; Annual Convention, Hotel Traymore, Atlantic City, June 1-3.

National Electrical Wholesalers Association—Annual Convention, Hotel Statler, Buffalo, May 3-7.

Missouri Valley Electric Association—Rural Round Table, President Hotel, Kansas City, May 5; Sales and Rural Conference, President Hotel, Kansas City, May 6-7.

Southeastern Electric Exchange—Spring Conference, Engineering and Operating Section, Tampa Terrace Hotel, Tampa, Fla., May 6-7.

Pennsylvania Electric Association—Communications Committee, Hotel Traylor, Allentown, May 6-7; Systems Operations Committee, Castleton Hotel, New Castle, May 13-14; Transmission & Distribution Committee, Irem Temple Country Club, Dallas, Pa., May 20-21: Prime Movers Committee, Hotel Casey, Scranton, June 10-11.

Northwest Electric Light & Power Association—Annual Business Meeting, Empress Hotel, Victoria, B. C., May 10; Business Development Section Empress Hotel, Victoria, B. C., May 10-12; Accounting and Business Practice Section, Davenport Hotel, Spokane, May 17-18; Personnel Section and Safety Conference, Medford Hotel, Medford, Ore., June 9-11.

Engineers Club of Philadelphia—Engineering Progress Show, co-sponsored by junior members and the Franklin Institute at the Institute, May 11-16.

Electrical Manufacturer's Representatives Association of Michigan—Industrial Electrical Exhibit, Convention Hall, 4484 Cass Ave., Detroit, May 12-14.

New Jersey Utilities Association—Spring Meeting, Seaview Country Club, Seaview, N. J., May 14.

Interstate Power Club of New York—May Meeting, Hotel Martinique, New York, May 17.

American Public Power Association—Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., May 17-19.

Public Utilities Advertising Association—Annual Meeting, Hotel Cleveland, Cleveland, Ohio, May 27-28.

American Society of Refrigerating Engineers—Spring Meeting, New Ocean House, Swampscott, Mass., May 31-June 2.

Arkansas Utilities Association—Annual Convention, Arlington Hotel, Hot Springs, Ark., June 14-15.

Pacific Coast Electrical Association—Annual Meeting, Fairmont Hotel, San Francisco, June 16-18.

Canadian Electrical Association—Annual Convention, Manoir Richelieu, Murray Bay, Province of Quebec, June 16-19.

American Society for Testing Materials—Annual Meeting, Book-Cadillac Hotel, Detroit, June 21-25.

2 Parts of Taft-Hartley Act Will Be Reviewed

Two provisions of the Taft-Hartley Act involved in the coal strike will be considered by Sen Joseph H. Ball's "watch-dog" committee when it begins hearings May 24, on the operation of the law over the past nine months.

They are 1. The "national emergencies" section, which dealt heavy fines this week to John L. Lewis and his United Mine Workers for disobeying a court injunction, and 2. A part of the law which regulates employee welfare plans to which employers contribute.

Lewis' victory on the pension fight has raised a target at which other union leaders, particularly CIO President Philip Murray, will shoot. Murray, as president of the CIO Steel Workers, is seeking social insurance for his members. Basic steel producers who own captive coal mines and pay the pensions to the miners are in a difficult position in bargaining with Murray on this issue.

Murray holds another ace—the National Labor Relations Board decision that employers must bargain on pensions when requested. As to Murray's union, there is one contingency, however. It must first qualify under the Taft-Hartley Act by filing non-Communist affidavits with NLRB.

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December 1947 Energy Production Hits New High

Production of electric energy by electric utilities during Dec 1947 totaled 23,511,913,000 kwhr, The Federal Power Commission reports. This is the highest monthly production of record, exceeding the previous record of Oct 1947 by about 1.2 billion kwhr, or 5.3%. It also exceeded Dec 1946 production by 12.8%.

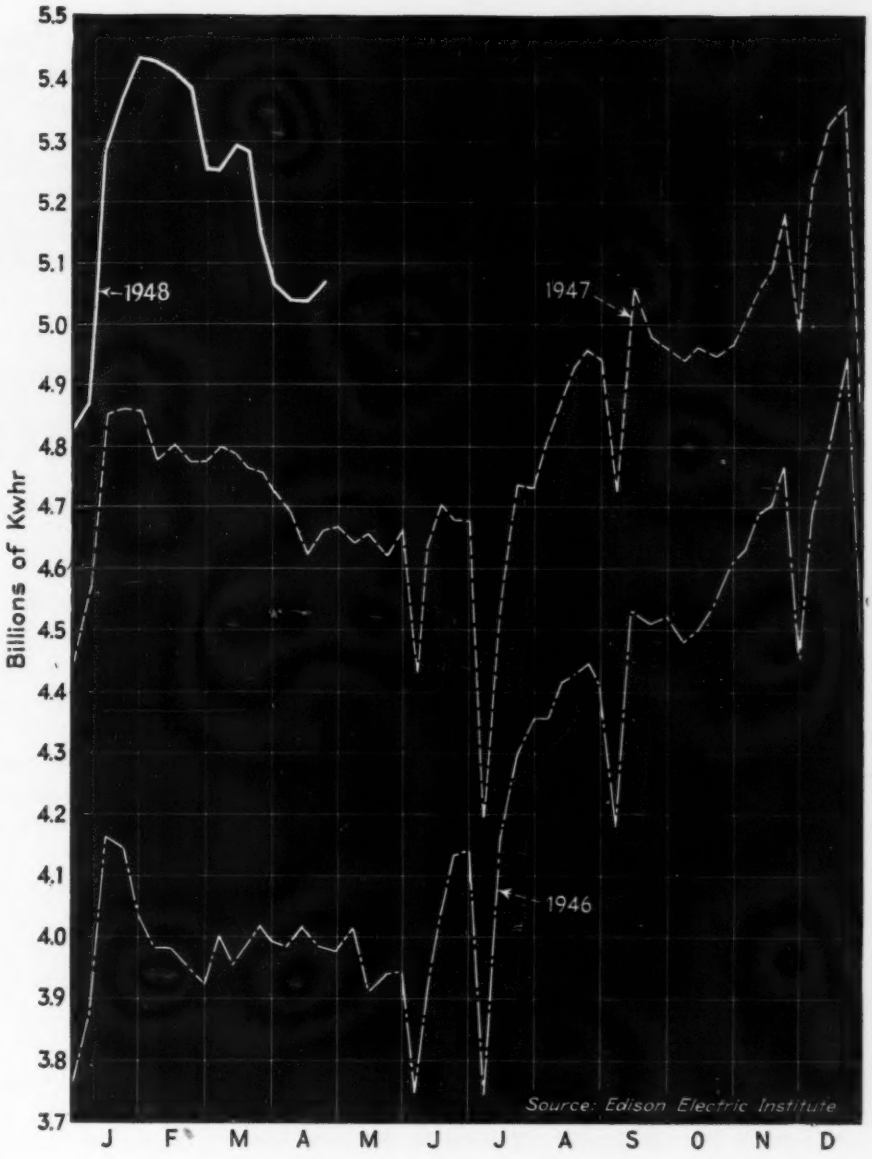
Water power plants of electric utilities produced 6,412,699,000 kwhr of the December energy total, or 27.3% of the total.

Industrial production, including generation by railway and railroad plants was 4,439,191,000 kwhr in Dec 1947, an increase of 10.2% over the same month of the preceding year. Combined utility and industrial production was 12.4% higher in Dec 1947 than during the same month a year before.

•

Municipal Expanding

Henderson (Ken.) Municipal Light & Power plant will add two 1,000-kw generators to its present 5,000-kw capacity. Oil or gas will be useable as fuel.



Truman's Got Troubles—Arput Gets Sorry

ARPUT, our output editor, is non-political. "But I'm certainly sorry for Truman," he mourns. "He's got troubles.

"The South is in the bag for any Democrat, it says here. But Dixie gets so burned over Harry's Civil Rights plan that its revolt forces Harry to announce his candidacy. Now, our reversal on Palestine upsets New York delegates. If he switches on either, the opposition just switches reasons for being mad. Farmers want high prices. City folks want 'em low. About all Harry can be against is Russia and the utilities. Harry's political chances just keep going down. But last week, for the first time in six weeks, the output went up.

Other News

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Weekly Output, Millions Kwhr

1948		1947		1946	
Apr. 17	5,087	Apr. 19	4,660	Apr. 20	3,987
Apr. 10	5,033	Apr. 12	4,620	Apr. 13	4,015
Apr. 3	5,037	Apr. 5	4,693	Apr. 6	3,988
Mar. 27	5,065	Mar. 29	4,729	Mar. 30	3,992
Mar. 20	5,145	Mar. 22	4,759	Mar. 23	4,017
Mar. 13	5,285	Mar. 15	4,764	Mar. 16	3,988
Mar. 6	5,293	Mar. 8	4,787	Mar. 9	3,953
Feb. 28	5,252	Mar. 1	4,797	Mar. 2	4,000

Percent Change from Previous Year

	Apr. 17	Apr. 10	Apr. 3
New England	+ 8.3	+ 8.3	+ 7.6
Mid-Atlantic	+ 9.0	+ 9.0	+ 4.5
Central Industrial	+ 8.4	+ 7.8	+ 7.2
West Central	+ 6.3	+ 5.1	+ 5.7
Southern States	+12.7	+12.7	+10.3
Rocky Mountain	+12.1	+11.3	+10.6
Pacific Coast	+ 6.1	+ 6.6	+ 6.2
Total United States..	+ 9.2	+ 8.9	+ 7.3

WASHINGTON COMMENT

WILLIAM B. WHICHARD

PAUL G. HOFFMAN'S recent switch from a top spot in the automobile industry to a federal job came as a double-barreled surprise to many veteran Washington observers. Not that his appointment as administrator for Economic Cooperation was unexpected—it had been rumored for days.

Hard-boiled Washingtonians, both bureaucrats and newsmen, simply get a jolt every time anyone leaves a top industry post to accept a federal appointment. They can understand such moves in times of war or extreme emergency, when government service becomes patriotic duty. Otherwise, the political uncertainties and inadequate compensation make federal jobs hardly worth the time and effort.

Just as surprising to these sources as Hoffman's acceptance of the Marshall Plan post was his selection by the White House. Few Truman appointments have met such wide acclaim. Of many, the best that could be said was that they were ill-advised. And it is doubtful whether any single factor so damaged Mr. Truman's prestige as the protest greeting the George Allen, Ed Pauley and Tom Vardaman nominations.

Actually, the Truman record on major appointments has not been bad. He has managed to draft, or keep on the job, men like Marshall and Forrestal for the really vital posts. His choices for lesser jobs, however, have been singularly more drab.

More alarming, of late, has been the effect of pressures applied by various groups upon either the President or those who advise him on appointments. One of the sorriest examples of this has been the on-again-off-again ruckus over the FPC vacancy.

Burton Behling, FPC staff member, was the President's first choice to replace retiring Commissioner Sachse last spring. Behling was nominated again in January after the Senate failed to confirm him during the summer session. Meanwhile, a fateful split had developed within the Commission, with Behling lining up with Commissioners Smith and Wimberly in favor of revisions of the Natural Gas Act. Commissioners Olds and Draper disagreed—but violently.

Behling's renomination thus had the appearance of a White House stamp of approval of the Smith-Wimberly views toward Gas Act amendment. But apparently the White House had not kept up with the FPC schism, though it got more publicity than it deserved.

When a group of liberal Senators, headed by Wyoming's O'Mahoney, demanded a White House stand against changing the Gas Act and for withdrawal of the Behling nomination, the President hesitated. At the last minute, he recalled the nomination.

The inevitable compromise followed. Commissioner Wimberly, whose term expires in June, was reappointed. At the same time, Thomas C. Buchanan, whose record clearly stamps him as a New Deal liberal of the O'Mahoney type, was named for the FPC vacancy. Confirmation of Buchanan, a self-professed admirer of Leland Olds, obviously would throw the balance of power in FPC to the Olds-Draper faction. Even a White House adviser cannot expect Senate conservatives to accept that eventuality.

TECHNICAL TRENDS

ARCHER E. KNOWLTON

Voltage-chasing schemes are useful in facilitating the division of boiler-house auxiliaries between buses for security along with minimized duplication. Loss of generation can be offset by a transfer breaker that connects the auxiliaries to supply from the outside system.

Carrier control as conceived for street lights and water heaters is being applied to remote control of high voltage sectionalizing switches and capacitor banks.

To prevent accidents, insist that design engineers discuss every possible hazard with safety and operating people before drawings are "frozen". Congestion and inadequate clearances may save a few dollars initially but waste thousands in distressing casualties.

Industrial load is not as advantageous as some utilities would like it. One-shift operation makes diversity poor, rates are low even with protective fuel clauses. Automatic salvation short of rate boosts can only come as the utilities get the more efficient new generating stations on the line.

Diesel-powered generators are being installed in small hydro-electric plants to supplement the water wheels when water runs low.

A mica splitter devised at the National Bureau of Standards can turn out 3 to 4 times as many sheets per hour as the average hand splitter. Neither, however, achieves precise uniformity in thickness.

Alternator voltages seem to be climbing as machine ratings pass 100,000 kw. Higher voltages—no sign yet of the 22 and 33 kv of earlier British practice however—ease the design of leads, bushings and collector rings by imposing smaller currents.

Outside-in supply of the cities is the coming pattern. Substations spotted on medium-voltage rings at locations out of the high-cost land areas will supersede the from-inside-out pattern of many communities.

LASHING AERIAL CABLE in the field. As lashing machine moves along the supporting messenger, the three single-conductor cables pass between fingers of the stringing trolley and over sheaves that form them into a triangular configuration before they enter the spinner (right) that binds them to the messenger with copper wire. The trolley shown is an early experimental model

Spinner Lashes Aerial Cable In Field

J. A. LASSETER and F. E. TREAT
Florida Power & Light Co
Miami, Fla.

Florida utility develops method of lashing aerial cable to messenger in field by means of traveling spinner. Finds installation cost lower than with preassembled cable. Separate purchasing of messenger and cable offers other savings

INSTALLATION of aerial cable in the field using a traveling "spinner" that lashes one, two or three single-conductor cables to an installed messenger has been proved feasible by the Florida Power & Light Co. The method, an adaptation of the scheme used by telephone companies for lashing communication cable to messenger in the field, has been used in three installations aggregating about 20,000 ft. This installation scheme has several advantages over the use of preassembled cable. Labor costs of installation, for example, are two-thirds that for preassembled cable.

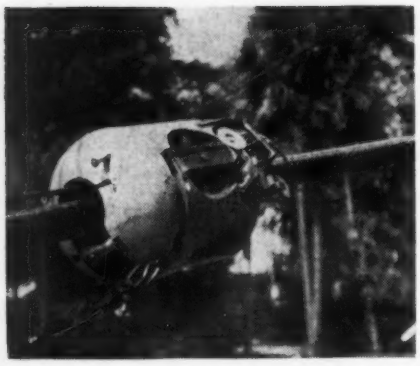
Aerial cable is being applied at present on our system in areas where conventional open-wire construction is not suitable because of building density, hazardous tree conditions or congestion on existing pole lines. It also is being used as reinforcement against storm damage in express sections of important distribution feeders that serve areas of high load density.

To date 500,000 conductor feet of aerial cable have been ordered to meet these conditions. Of this amount about 60,000 conductor feet or 20,000 circuit feet have already been installed by the company.

Originally the plan was to purchase "preassembled" cable consisting of one or more single-conductor, rubber-like insulated, Neoprene-jacketed cables bound to a Copperweld messenger with a flat copper tape. But the estimated labor cost of installing the larger sizes and anticipated installation difficulties led us to investigate methods of lashing cables to the messenger in the field with a cable lashing machine.

Tests with a borrowed Bell System lashing machine showed that this was not only feasible but that this method of installation would have several decided advantages over the installation of preassembled cable, including lower installed cost. As a result, single-conductor cable was ordered for the entire program, with the exception of 90,000 conductor feet of preassembled cable that had been on order prior to the test.

The only lashing machines commercially available at the time were for use with one cable having a



EXPERIMENTAL MODEL of the Model K spinner in operation. One coil of lashing wire is seen on the side of the machine. Another is on the opposite side. As the machine is pulled to the left along the messenger, the drum containing the lashing wire coils revolves, binding the cable tightly. The cables are 300,000 cir mil 5 kv

maximum diameter of 2¼ in. For aerial cable spinning we needed a machine to handle three single conductor cables with diameters up to 1¾ in.

Since the tests were made, the Cable Spinning Equipment Co of Topeka, Kansas, has developed such a cable lashing machine, commonly known as a "spinner". A guide or "stringing trolley" is also available, which when pulled along the messenger ahead of the spinner, picks up, straightens and forms the cables into a triangular configuration. Its use eliminates the need for temporary cable rings. Experimental models of the spinner and stringing trolley are shown in accompanying pictures.

Initial Installation

First installation made with this equipment was an 8,000 ft run of three single-conductor 300,000 cir mil, 5-kv cables lashed to a ½ in. Copperweld messenger. Normally a 9/16-in. messenger would be used for this size cable. But it was not in stock. This aerial cable was installed in one leg of a split 4,160-v wye feeder with the messenger as the neutral. Cable was used in this case to avoid pole congestion and to balance the voltage regulation with that on the open-wire leg of the feeder. Cable conductors involved have 11/64 in. butyl insulation, metallic shielding and a 6/64-in. Neoprene jacket overall.

Installation procedure involves four major operations: (1) installation and prestressing of the messenger; (2) pulling in the cables; (3) lashing the cables and (4) splicing. Each operation will be taken up in turn in the following sections of this article.

Installing the Messenger

Messenger suspension clamps are installed first. They have a supporting body that holds the messenger out away from the pole so the cable will not chafe.

Pulling blocks are fastened to each pole just under the messenger suspension clamps. These blocks have a single flat sheave 5 in. wide and are attached to the pole by a linked chain and screw arrangement. They are used first to pull in the messenger and later, without relocation, to pull in the cable. Blocks with concave sheaves were tried but resulted in twisting the cable. Others with three single sheaves were discarded because it was difficult to feed cables into the individual sheaves.

After the messenger is pulled in for the entire run, the slack is taken up. The messenger then raised and placed loosely in the suspension clamps and brought up to prestress tension. This tension is applied for 24 hours when a check reading is taken. If less than 75% initial tension is found, (temperature considered) guys, poles, etc, are inspected to find the cause of the slippage. Finally, the messenger is slacked off to predetermined unloaded tension, deadends made up, and bolts on suspension clamps tightened.

By prestressing the messenger, the structures, messenger, messenger splices and guys are subjected to better than storm loading without subjecting the cable to damage in the event of a failure. Moreover, practically all of permanent stretch is removed from messenger, insuring consistent final loadings and sags. This is an important point in favor of spinning aerial cable rather than installing preassembled cable.

Anchor guys are designed for storm loading rather than ultimate strength of the messenger. It was felt that the failure of an anchor guy would result in less damage to the cable than the failure of a messenger. As a result, the messenger prestress tension is limited to a value that will not load the anchor guys above 70% of ultimate strength. In general, the present design of anchor guys allows the prestress tension to be 50% of the ultimate messenger strength.

Three cable reels are set up in tandem at one end of the run, each with 3,000 ft of cable. A roller bearing swivel is served to each conductor and a rope bridle attached to these swivels. A fourth roller-bearing swivel is cut into the pulling line. Initial attempts to pull the cable with ordinary swivels resulted in twisting which, for successful spinning, must be avoided.

Cable pulling is done with a line truck. No braking is used on the reels and the cable is allowed to sag between poles. Spinning would have been somewhat easier, however, if a small amount of braking had been used. Pulling tension was not measured but it was estimated that it did not exceed 2,000 lb at any time on a 3,000 ft straight pull. Each length of cable was lashed to the messenger with the spinner before starting the next pull. Eight foot overlaps were left for staggering splices.

Pulls around corners were not attempted on the initial job. In later jobs they were made by arranging an empty wire reel so that it would turn freely on its side at ground level, like a pulling block. When the pull was completed, the cables were lifted up to the messenger.

While cables are being pulled in they must be kept above obstructions like trees, communication cables crossing under the messenger and traffic. To do this pulling blocks, fitted with suitable clamps, are hung from the messenger above the obstructions. If preassembled cable had been used it would have been necessary to install a temporary messenger to do this. The cost of such a messenger would constitute a sizable factor in the total installed expense of preassembled cable.

Lashing the Cables

During lashing operations the spinner rides along the messenger on two small grooved wheels. Cables are carried through the machine on pulleys at the front and rear of the machine. The rear pulley is adjustable so that the cables at the rear of the machine are held snugly against the messenger in a triangular configuration. As the machine is pulled along the messenger, the drum containing

the lashing wire rotates around the entire assembly, binding the cables tightly to the messenger. Lashing wire tension is about 35 lb.

The Cable Spinning Equipment Co's Model K experimental power cable spinner has two reels of lashing wire in the revolving drum. The drive ratio of the drum results in a lay of about 16 in. for each wire. But, since the two wires are applied 180 deg apart, the apparent lay is about 8 in. A 325-ft coil of lashing wire is enough for two 140-ft spans. The size now used is No. 10 round medium hard drawn bare copper.

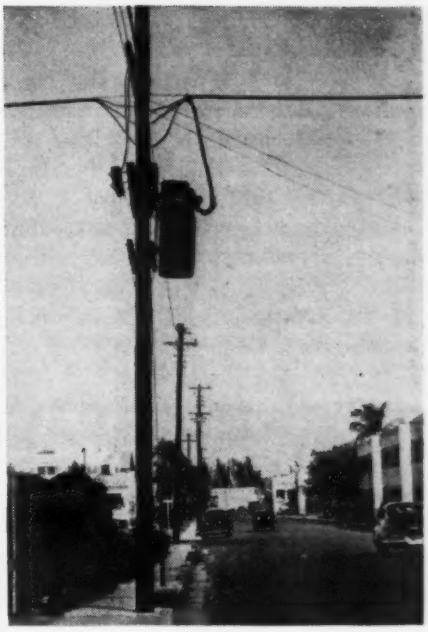
Spinning Technique

Three fingers in front of the stringing trolley, that is pulled along ahead of the spinner, straighten out any twists within the span. Behind these fingers is a large flat pulley that supports the weight of the cables. A second parabolic-shaped pulley, at the rear of the trolley, forms the cables into a triangular configuration with the apex pointing down. The trolley, like the spinner, rides the messenger on two grooved wheels.

To lash the cables, the trolley is first placed on the messenger and the cables laid between the fingers and on the pulleys in the order of desired phase sequence. Gates of the spinner are opened, the spinner placed over the messenger behind the trolley and cables lifted into place. Lashing wire is tied off temporarily on the messenger with thumb screw clamps. At this point the trolley and spinner are pulled to the next pole, applying the lashing to the cable as it goes.

Both the spinner and trolley are pulled from the ground with one line so arranged that the spinner rides 3 ft behind the trolley. While manpower or a truck can be used for pulling, manpower gives better control. Four to six men are required for this.

When the spinner reaches the next pole the lashing wire is tied off temporarily. Enough slack wire is pulled out of the coils to terminate it around the messenger suspension clamp, when it is cut. Trolley and spinner are lifted off the messenger and passed around the pole, replaced on the messenger and the cycle repeated. A copper cable hanger is installed 24 in. each way from the messenger suspension clamp. The lashing wire is terminated by mousing it around the messenger on the far side of messenger suspension clamp.



CABLES ready to be lashed (left) are carried over street intersection on a pulling block attached to the messenger. Other blocks are located at the poles just under the messenger suspension clamp. Slack in aerial cable is left at the pole (right) to clear the messenger suspension clamp. Copper cable hangers are installed where the cables break away from the messenger to prevent the lashing wire from cutting into the jacket. Additional slack may be left at this point for future taps if desired

It takes from 10 to 20 minutes for two men to pass the spinner and trolley around the pole; depending on the size cable and experience of the crew. Time to lash a span after the trolley and spinner are placed around the poles is only the time taken for the men to walk the distance between poles.

Slack can be left in the cable at any pole to provide for taps if desired. On secondary cable, forks are installed below the messenger and the cables looped down to the forks for service. About 8-in. sag is left below the messenger suspension clamps at each pole to allow for future taps on primary cable. This slack can be worked along the messenger when the tap is actually made.

Splicing

Only new splicing problem encountered with the use of aerial cable was procurement of suitable solderless connectors for a shielded wye or tee joint and a tape, to apply overall, that would withstand the sun indefinitely.

Solderless connectors were desirable to avoid use of heat with rubber-insulated cables. On straight splices, the compression-type sleeve is being used satisfactorily. Connectors initially considered for the shielded wye or tee joint were too irregular in shape to tape without leaving voids or undesirable stress distribution. Burndy Engineering Co later developed a line of suitable compression-type wye connectors and Fargo has developed a suitable 45 deg mechanical tap connector.

Individual splices in a multi-conductor cable are staggered and bound to the messenger with cable hangers when completed. Polyethylene was used for the outside layer of tape because of its good sunlight and wetting qualities. It is a little difficult to apply without wrinkling. But a layer of good rubber tape directly under the polyethylene will protect the splice from moisture. No overall insulating paint is used. The first splice has been in service only a year.

Porcelain potheads are not used for terminating either the 5-kv or 15-kv cables. A stress cone is built up to terminate the shielding tape before polyethylene tape is applied overall. To prevent migration of moisture through the strands, a compression sleeve with a water-tight slug in the center is compressed on the end of the cable conductor. A piece of bare wire is compressed in the other end of the sleeve for connection to the

device in which the cable is normally terminated.

It takes the best part of a day for a splicer and helper to splice three single-conductor metallic-shielded primary cables. Metallic shielding tape on primary cables is bonded to the messenger at intervals not exceeding 400 ft. These bonds are usually within arm's reach of a pole. The messenger is connected to all available pole grounds with an inexpensive rural-type tap connector.

Splices in secondary cables are made by the linemen when the cables are lashed. Compression type sleeves are used for straight splices and mechanical connectors for taps. The joints are insulated with a rubber tape and covered overall with an asphalt base tape.

It has not yet been necessary to make a hot tap on a primary cable. But we believe hot taps can be made safely on cables operating at 4 kv. Plans are being made to do this when it becomes necessary. We do not plan to make hot taps on cables operating at 13 kv.

Cable and Messenger Sizes

Cost of handling cable makes it desirable to keep the number of sizes to a minimum. Insulation cost is large compared to the copper cost, especially on the smaller sizes, so there is no economy in attempting to duplicate all wire sizes used in conventional open wire construction.

For our projected program, it was decided to purchase No. 4, 1/0 and 300,000 cir mil in the 5-kv class; No. 2, 1/0 and 4/0 in the 15-kv class; and No. 2 and 4/0 in the 600-v class. The 4/0 size in the 15-kv class has since been changed to 300,000 cir mil to more nearly equal the current carrying capacity of the 350,000 cir mil PILC underground cables which often constitute a portion of the 13-kv feeders.

Three sizes of messenger are adequate for all combinations of these cables. Sizes selected were $\frac{3}{8}$ in. (7 std. No. 8), $\frac{1}{2}$ in. (7 std. No. 6) and $\frac{9}{16}$ in. (19 std. No. 9) 40% HS Copperweld. In general, the conductivity of the messenger is 30% or more of the cable size with which it is generally used.

The dominating factor in determining messenger strength requirements was the desire to hold sags to the practical minimum. We felt that it would be pennywise and dollar foolish to disregard appearance of aerial cable installations by condoning sags with that "draped" look. A sag of 20 in. in a 125 ft span at 60 deg was selected as the upper limit. Other limiting factors included: (1) An initial messenger tension (with cables in place) not exceeding 35% of its ultimate at 60 deg and no wind; and (2) a tension not exceeding 50% of the ultimate messenger strength with a wind loading of 20 lb per sq ft at 60 deg. These limitations result in initial messenger tensions (with cables in place) running from 3,500 lb for 3/c No. 4 up to 8,200 lb for 3/c 300,000 cir mil.

After making several installations with this basis for messenger tensions we observed that sags are less than calculated due partly to strength contributed by the lashed cables. As a result we decided to reduce initial tensions in the future about 14%, or from 35% to 30% of ultimate messenger strength.

The same size messenger is used with one conductor cable as with three single-conductor cables of equal copper size and voltage class. This lets additional conductors be added later without disturbing the messenger or existing conductor. In such additions, the spinner can be rigged to remove the existing lashing wire and lash on additional conductors in one operation. If preassembled cable were used however it would be necessary to add another assembly or replace the existing one.

Purchase of single conductor cable and messenger separately results in other savings. The practical length of larger size 3/c preassembled cable is limited to about 1,000 ft because of weight. Single conductor cable can be handled in lengths up to 3,000 ft thus reducing the number of splices and the labor of installation.

Installation of cables with a spinner permits 1/c, 2/c or 3/c cables to be made up in the field as required. It is unnecessary therefore to stock these items separately, as would be the case with preassembled cable. This stock pile of single-conductor cable has proved invaluable in emergencies.

In a hypothetical case where it is planned to construct a 4 kv 400 amp express feeder on existing pole lines, it has been estimated that the initial cost of aerial cable will run from 50% to 100% higher than open wire. But this does not include the cost of additional pole height that would probably be required for open-wire construction or any of the other factors mentioned.

Cost Analysis

Our actual labor costs for installation of aerial cable might be of interest. Our initial installation consisted of 8,000 ft of three 1/c, 5-kv 300,000 cir mil cables lashed to a $\frac{1}{2}$ in. messenger on an existing pole line and had two 90 deg bends in the run. Pole spacing averaged about 115 ft. Total labor costs ran about $420 per thousand ft. This includes installation of the messenger and anchor guys, pulling in and lashing of the cables, splicing, installation of terminal equipment, and construction delays. The job was done by a ten man crew which had no previous experience with cables or a lashing machine.

Labor costs for another installation consisting of some 7,000 ft of three 1/c, 600-v 4/0 cables lashed to a $\frac{1}{2}$ in. messenger ran about $430 per thousand feet. This particular job consisted of a number of short runs on rear property lines.

Recently 4,200 ft of three 1/c, 15-kv 300,000 cir mil cables were installed on a $\frac{9}{16}$ in. messenger. The labor for this job ran approximately $900 per thousand, or more than double that of the first installation. There were extenuating circumstances in the latter case but it is mentioned to emphasize that labor costs given above are based on relatively little experience and should be considered in that light.

Only one installation has been made with preassembled cable. It is an 1,800 ft run of 3/c, 4/0, 5-kv cable on existing steel poles. Difficulty was experienced in keeping the cables from riding on top of the messenger and it was necessary to go back over the cable after it had been pulled in place to work out the twists. Labor cost ran about $683 per thousand feet. This job was installed by a crew with no previous cable experience working from ladders. This labor cost would have been somewhat lower if wood poles had been involved and if no attempt had been made to roll out the twists.

HEATING PANELS are of different types, and are usually installed below windows for effective circulation of heat

Radiant Heating Makes Strides In Norway

HAKON KINCK
Architectural Division
Kinck Hydraulic Construction Co
Oslo, Norway

Photos by Royal Norwegian Information Services
New York 20, N. Y.

Panel and smooth pipe heaters predominate . . . Power requirement estimated at 20 watts per cubic meter

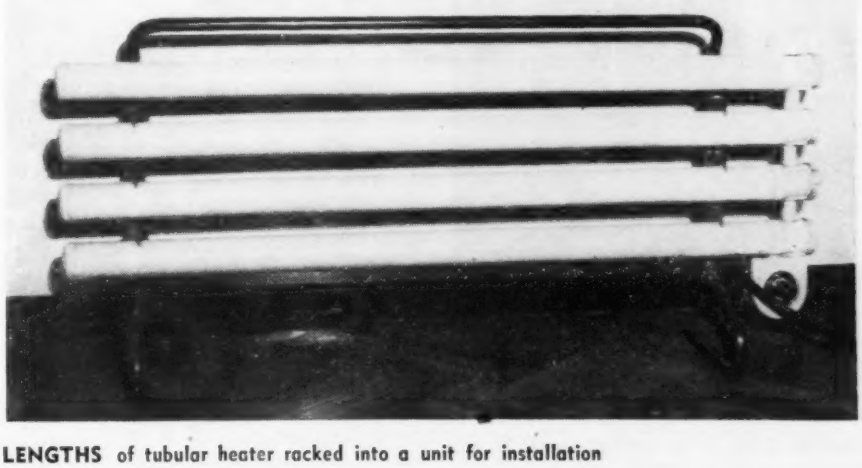
IN NORWAY electricity is used to heat all types of homes—wood, brick, and concrete—which generally have much better heat insulation than is usual in this country. Homes commonly have full basements, and most have double-glass windows.

Power for heating is sold generally at an annual rate per kw, which includes a stated number of kwhr, plus an additional charge per kwhr for excess above the fixed amount. In Oslo, for example, the consumer subscribes for a fixed amount of power according to the number of rooms: for 2 rooms 300 w, for 3 rooms 600 w, and for 4 rooms or more 900 w. The price is 170 kr (kroner) per kw per year. This is approximately $34.00 per kw per year. Excess consumption is charged at the rate of 2 oere, or approximately 4 mills per kwhr. Before the war, the cost of installation was estimated at 47 kr per interior cu m (35.31 cu ft) to be heated. Now, however, this cost has increased to 60 to 70 kr, or approximately 40¢ per interior cu ft. Electricity requirements are calculated at from 40 to 50 kwhr per cu m (1.14 to 1.41 kwhr per cu ft) per year.

Temperature statistics for Oslo, based on observations since 1894, show that on the average, only 11 days per year have a lower median temperature than —10 C (14 F), and not less than 39 days have a lower median temperature than —5 C (23 F). The heating season is approximately 210 days included in the period September 15 to May 15.

Electric heating in Norway is mostly by radiation. Early types of heaters consisted of resistance spirals backed with tin plate reflectors from which most of the heat was given off by connection. This method left much to be desired as air movements deposited dust on the hot spirals where it burned with a disagreeable odor.

The latest panel heaters have an 80 C (176 F) surface temperature. The insulation has been improved so that 40% of the heat is released by radiation. The air is also heated. The combination of heat rays and heated air is excellent, since ray heating alone from a high temperature heater has an unpleasant effect. By correct placement of the heating unit, the energy rays are directed most advantageously—preferably against the floor in order to heat the lower parts



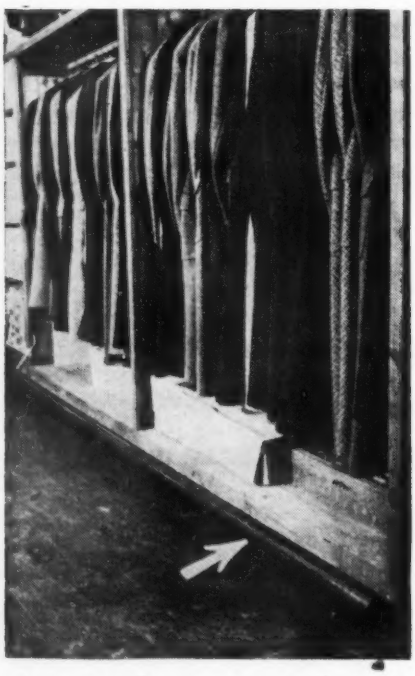
LENGTHS of tubular heater racked into a unit for installation

of the room first. To obtain full and even heating the units should be strategically installed about the room.

The main problem thus far is the surface temperature of the panel. It should be as low as possible; but economy and space must be considered. The lower the surface temperature, the greater the surface area required to produce the same heating effect. This increases the cost and more wall space is required for installation. If the surface temperature is raised, the cost per kw decreases, but the ray effect may be too intense.

Heater types most in use are panels consisting of resistance elements embedded in insulation and enclosed in sheet steel housing. Surface temperatures range from 80 C (176 F) to 100 C (212 F). Panel thickness is 2 in. and the length and width are variable according to requirements. The panels are fastened directly to the wall, by preference under windows, and are enameled in various colors suitable to particular rooms. Long curtains cannot be used as they would hang over the heater and reduce effective radiation.

In addition to panels, Norwegian builders are also using smooth pipe heaters with and without reflectors. These are cheaper and are suitable for the less important rooms in a home. For bath rooms, ray heaters are placed higher on the wall or over the door, thus eliminating the risk of direct contact. Other heating types are installed as mats and cables laid in floors, walls and roofs.



FLOOR RAIL is an electric heater in this storage space for clothes

The size of the electric heating system is determined by calculations based on the lowest outdoor temperature of minus 15 C (5 F) and the fixed temperature for the various rooms. The latter include: 20 C (68 F) for living room, 15 C (59 F) for bedrooms, 10 C (50 F) for halls and exterior rooms, and 25 C (77 F) for bathrooms.

Design Criteria

Factors in design of electric heating installations are construction of the building (whether of wood, brick or concrete), thickness of the walls, sizes and types of windows, kind of roof and floors, and even the direction in which the building faces. In Norway it is most important that there be double glass in the windows. Tests have shown that heat lost from a double window of 2 sq m amounts to 285 w, while the loss from a single pane of the same size is 570 w. It has also been found that the difference between the single and double pane causes an increased energy consumption of 684 kwhr per year. At the price of 2 oere per kwhr, and for 9 sq m (96.3 sq ft) of window space, the loss costs about $12 yearly.

In rooms with windows of varying sizes and with one or two outside walls, installations run from 16 w to 32 w per cu m (35.31 cu ft). In halls and outside walls, installations run from 16 w to 32 w per cu m (35.31 cu ft). In halls and outside rooms the average is 10 w per cu m; in bathrooms with no outside walls 15 w and in bathrooms with outside walls 40 w per cu m. Considering the house as a whole, the installation requirements are estimated at 20 w per cu m.

Temperature regulation is usually by thermostat in each room. The thermostat is placed at shoulder height, away from drafts and where the temperature may be accepted as average for the room. Where several heaters are installed in one room, only a section of each heater is coupled to the thermostat, making it possible to distribute regulation over the entire room. Were the whole heater thermostatically regulated, the switching on and off would result in uncomfortably high heat contrasts. Where there are two heaters in one room, one third of each heater is connected to the thermostat and the remaining two thirds controlled by one switch.

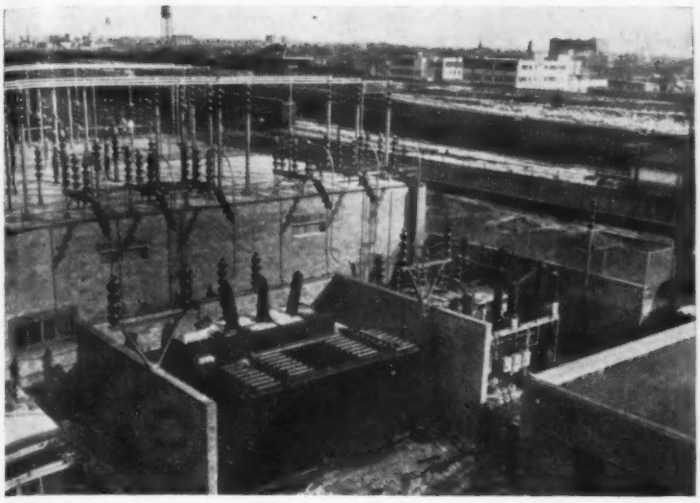
Another method is to use tapped panels allowing various combinations of series and parallel section connections under thermostatic control. This is a simpler method as far as installation is concerned, and in many cases constitutes the best solution.

Various tests have been made in structures with walls one and a half bricks thick, divided into apartments of 60 sq m (642 sq ft) floor area and volume of 162 cu m (5720.22 cu ft) each. The apartments where these tests were made were equipped with 1500-w 120-liter (31.7 gal) bathroom hot water heaters, 1000-w, 20-liter (5.28 gal) kitchen water heaters, and standard 4-burner, 3800-w electric cook stoves. Here the fixed power requirement for 3-room apartment was 600 w. The heating season lasted for a total of 210 days and the heat consumption was 50 kwhr per cu m (35.31 cu ft) for the period. Total electricity consumed for heating was 8100 kwhr per apartment, with most of the usage during daylight hours. Consumption for water-heating took place at night.

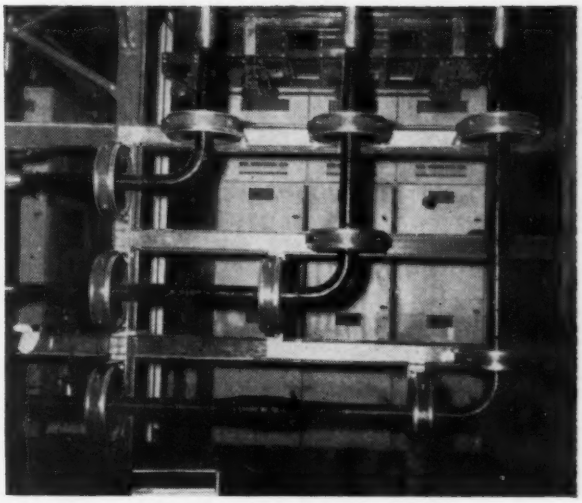
Total Consumption

The bathroom hot water heater was at half capacity or 750 w for 10 hrs, resulting in a per-night consumption of 7.5 kwhr. The kitchen hot water heater was set at one quarter capacity for 10 hr during the same period, or 2½ kwhr. Statistics show that 1 kwhr per person per day will cover most cooking needs. For lighting, about 0.5 kwhr per day is sufficient. On this basis, the total consumption for the heating season ran 11,145 kwhr and for the summer season 349 kwhr. With fixed consumption set at 3,024 kwhr, net use over the fixed consumption figure ran 8,470 kwhr. Total cost amounted to 280 kr per year or approximately $56.

In Norway, various communities are providing interest-free loans for the installation of electrical heating. The loans cover installation costs, heaters, thermostats and hot water tanks, and are to be repaid over 3 years in quarterly payments. Increasing numbers of builders are taking advantage of this assistance.



ARRANGEMENT of 132-kv circuits to 50-Mva, 132/27-kv transformer and to 132-kv cable terminals



27-KV, 3-PHASE metal-clad bus with covers removed. Air blast circuit breaker in rear

Bulk-Power Substation Saves Space With Double-Deck Construction

A. M. DE BELLIS
Inside Plant Engineer
Consolidated Edison Co of N. Y., Inc

Jamaica Substation designed for possible ultimate load at 450,000 kva . . . Structure conforms to limited area available . . . 132-kv buses and switches mounted on roof of 27-kv switchhouse . . . Layout results in lower overall cost

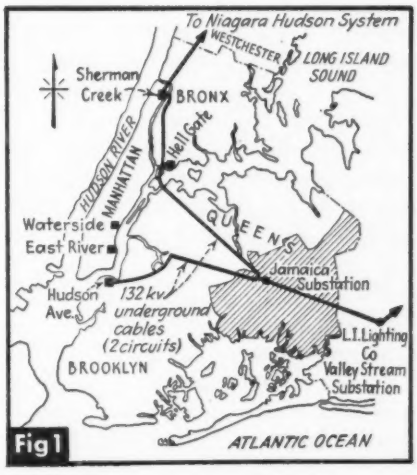
THE NEW JAMAICA Substation of the Consolidated Edison System will supply 27-kv feeders for local distribution to the central section of the Borough of Queens.

Bulk power will be transmitted to the substation by two underground 132-kv circuits which will be part of the future 132-kv major transmission system between Hudson Avenue and Sherman Creek generating stations, Westchester County and the Niagara-Hudson System as shown on Fig 1.

The substation has been designed for an estimated distributed peak load of 300,000 kva although it would be possible to provide for a maximum load of 450,000 kva.

The 132-kv circuits will ultimately consist of two 175,000-kva underground lines from Hudson Avenue, two 175,000-kva underground lines from Sherman Creek and two 75,000-kva underground tie lines to the Valley Stream Substation of the Long Island Lighting Co. Ultimately a total of 36 outgoing 27-kv distribution feeders and six step-down transformers could be installed.

The initial installation which will be in operation in May 1948 consists of two lines from Hudson Avenue, one line to the Long Island Lighting Co, three step-down transformers and twelve outgoing 27-kv feeders. Extension of the two 132-kv Hudson Avenue lines to the Hell Gate Generating Station and installation of a fourth step-down transformer are scheduled for operation early in 1950.



LOCATION of Jamaica Substation

Basic Design

Two major requirements were the controlling factors in determining the physical arrangement and the type of substation design, namely:

(a) The substation was to be located in a residential section and was to be confined, if possible, within a land area already available.

(b) Standard equipment was to be used wherever possible. The type and the segregation of the equipment were to provide for a high degree of service reliability, safety to personnel, and

Adapted from paper presented before the Edison Electric Institute, Electrical Equipment Committee, at Chicago, Ill.

132-KV BUSES on roof and bus tie breaker in court

in addition, low maintenance.

Double-deck arrangement was finally adopted. The design has resulted in a compact layout which is reflected in a lower over-all cost and which, we believe, offers ample physical segregation for the 132-kv and 27-kv switching.

Various types of conventional outdoor station designs were considered and evaluated from the standpoint of space requirement, cost, reliability, safety and zoning limitations but none proved favorable for the circumstances.

All 27-kv equipment and the major 132-kv equipment are located at ground level. The 132-kv buses and related sectionalizing switches are mounted on the roof of the 27-kv switch house. Metalclad isolated phase 27-kv equipment is used throughout and, capitalizing on our operating experience with this type of equipment, no dividing walls have been provided between the various 27-kv bus sections.

Although consideration was given to the use of 27-kv outdoor metalclad equipment, it was found to be more economical to enclose the 27-kv switching structure and to use indoor equipment.

Simplicity and reliability have been the major considerations in the design of the switching arrangements. A one-line diagram of the 132-kv and 27-kv connections is shown in Fig 2. Fig 3 shows a vertical section through the 27-kv switch house and 132-kv equipment located on the roof.

All 132-kv circuits are equipped with 5-cycle oil circuit breakers and high-speed relaying to provide the maximum of service continuity in case of trouble either on the 132-kv circuits or on the substation transformer equipment.

In the ultimate installation with all the 132-kv circuits in service, the 132-kv buses will be operated in two separate sections.

Transformers

Transformer units rated at 50,000/66,500/83,300 kva continuous were selected. The 66,500 and 83,300-kva ratings are obtained by air blast and forced oil circulation cooling respectively. Estimated transformer daily load-cycles for summer and winter conditions are shown in Fig 4.

The voltage rating of the transformers is 132,000 v (138-kv class insulation) delta for the high voltage and 28,000 v (34.5-kv class insulation) wye, grounded neutral, for the low voltage.

On air blast cooling without exceeding a maximum hot-spot temperature of 93 C, each unit will carry the short time peak of the daily load cycle of 75,000 kva in the winter and 58,500 kva in the summer.

Under emergency conditions the transformer units will carry on air blast and forced oil cooling, without exceeding a maximum hot-spot temperature of 95 C, the short time peak loading of 100,000 kva in the winter and 78,000 kva in the summer.

Under similar conditions, the maximum load that the transformer will be able to carry without exceeding the maximum temperature of 105 C allowed by AIEE Standards will be about 110,000 kva in winter and 98,000 kva in summer.

Cost evaluations indicated some advantages in the use of this type of transformer equipment to carry emergency loadings rather than to provide additional reserve transformer capacity. Although the transformer losses are higher when operating with forced oil cooling, the unit would be operated under these conditions infrequently and for short duration. Thus, these losses are small compared with the cost of larger transformers. This neglects the higher core losses that would be present in larger transformers.

The transformers are provided with tap-changing-under-load equipment in order to maintain the 27-kv buses at the desired operating voltage levels, independent of any power transfer over the 132-kv tie system.

Switchgear

The high voltage breakers are 138 kv, 800 and 1,200 amp, 3,500,000-kva outdoor oil breakers with compressed air operators. The breakers use a self-contained compressed-air system to close. But they open by trip-coil action, springs and gravity only. The air storage tank has sufficient capacity, starting at normal pressure of 150 psi, to close the breaker five times. We do not plan to reclose these breakers automatically. Due to the 138-kv feeders being cable over their full length, no advantage would accrue from this practice.

The 27-kv breakers are 34.5-kv, 1,200 and 3,000-amp, 1,500,000-kva, indoor, air-blast type. These breakers use a separate compressed-air supply from four compressor units located in the switch room. Each compressor pumps the air initially to 250 psi into two storage tanks and supplies it through a pressure reducing valve to the pipe system at 150 psi for use in the breakers.

27-Kv Buses

The 27-kv bus arrangement has been dictated almost entirely by the requirements of the secondary-network distribution system that is to

be supplied from this substation. The following major requirements had to be met:

(a) The 27 kv buses should consist of four independent sections.

(b) The voltage phase-angle displacement between the four bus sections should be kept to a minimum.

(c) Loss of any one transformer should not affect the supply to the network.

A combination of four load buses and one synchronizing bus was chosen as the most practical means of meeting the above requirements. To eliminate the phase angle problem, the usual bus-tie reactors between the load buses and the synchronizing bus have been omitted.

Because the four load buses will be tied together through the synchronizing bus without reactances, there will be no voltage magnitude or phase-angle differences between the load buses. Thus, there will be no circulating currents through the network, due to these causes. As a further step towards simplification, no reactors have been installed on the outgoing 27-kv distribution feeders.

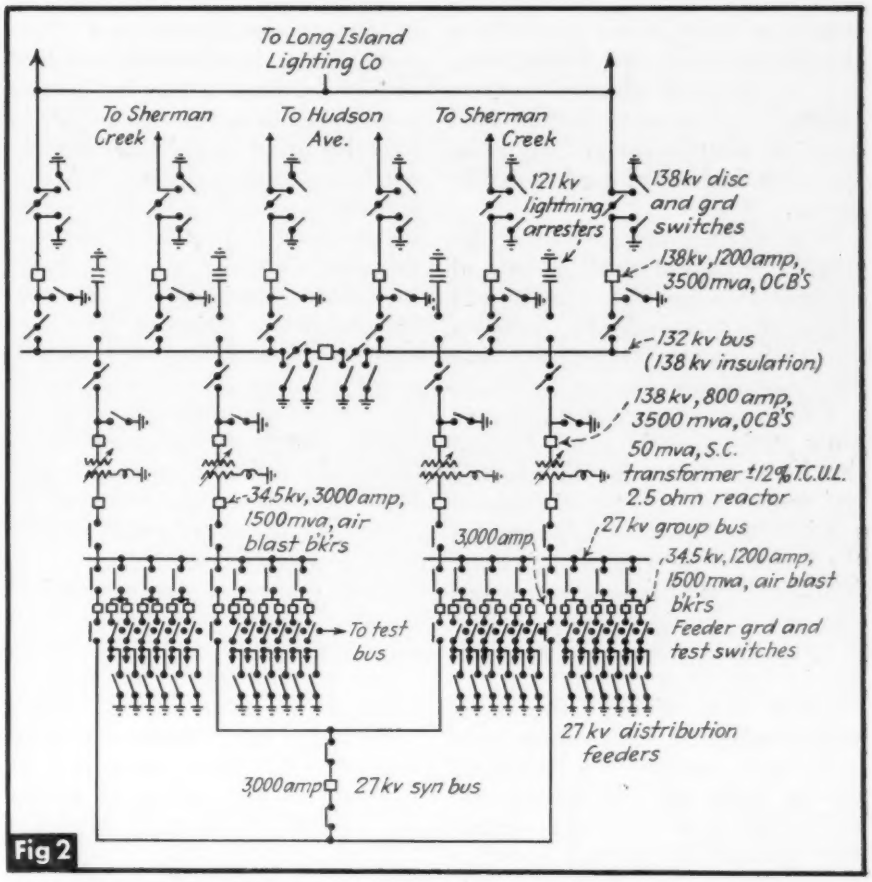
It was felt that feeder reactors could not be justified because of the following:

(a) Both line-to-ground and 3-phase, 27-kv faults will be cleared in 0.2 sec or less in all cases.

(b) It is anticipated that at least 75% of the 27-kv cable failures will be line-to-ground and will be cleared by high-speed ground relays before they develop into 3-phase faults.

(c) The voltage dip, on the two phases most affected on the secondary network as a result of ground faults on the 27-kv feeders will be limited to 25%, by the use of reactors in the transformer neutral connections. To avoid trouble due to operation of low voltage devices on customers' premises, we want to avoid voltage dips greater than 35% for 27-kv ground faults.

(d) Past experience indicates that not more than two or three, 3-phase, 27-kv cable faults per year may be expected. When 3-phase faults occur, the high-speed relaying should keep to a minimum the number of low-voltage-release operations on customers' equipment.


To Long Island Lighting Co
To Sherman Creek
To Hudson Ave.
To Sherman Creek
121 kv lightning arresters
138kv disc and grd switches
138kv, 1200amp, 3500mva, OCB's
132 kv bus (138 kv insulation)
138 kv, 800 amp, 3500 mva, OCB's
50 mva, S.C. transformer ±12½% T.C.U.L.
2.5 ohm reactor
34.5kv, 3000amp, 1500mva, air blast b'k'rs
3000amp
27 kv group bus
34.5 kv, 1200amp, 1500 mva, air blast b'k'rs
To test bus
Feeder grd and test switches
27 kv distribution feeders
3000amp
27 kv syn bus
Fig 2

SINGLE-LINE DIAGRAM of Jamaica transmission substation

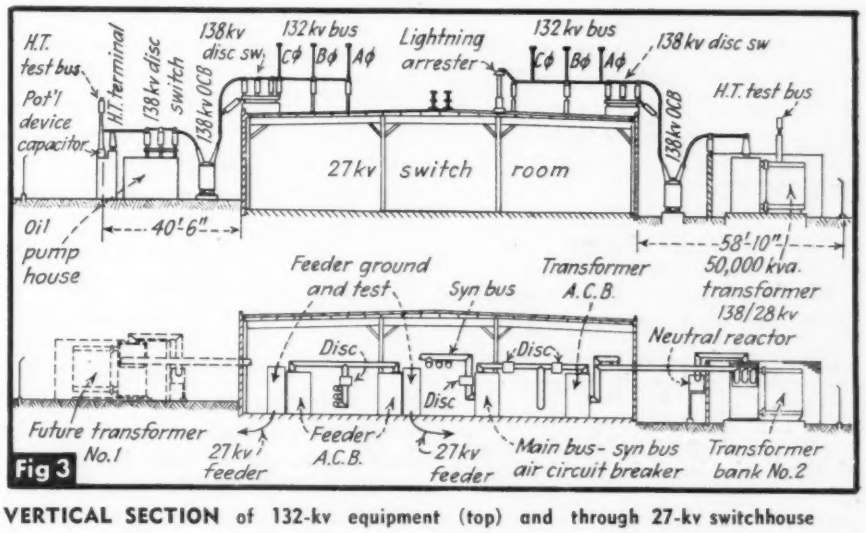


Fig 3

VERTICAL SECTION of 132-kv equipment (top) and through 27-kv switchhouse

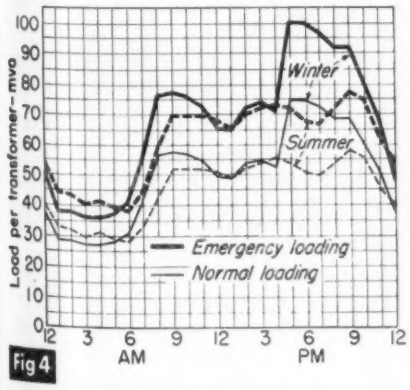


Fig 4

ESTIMATED transformer load curves for typical week-day schedule

Rupturing Capacities

Omission of bus tie and feeder reactors required the use of circuit breakers of a higher rupturing capacity: 1,500,000 instead of 1,000,000 kva. This has resulted in a lower cost than if reactors had been used to permit use of small circuit breakers.

The 27-kva switching has been

kept to a minimum by avoiding duplication of breakers and buses. From the standpoint of service continuity, it is expected that failure of any one breaker could, at most, affect one load bus. The distribution system is designed on the basis of one bus section outage.

It is expected that because of the type of equipment used, in case of equipment failure, the damage will be confined to a small area and service to this area can be restored without serious delay.

Following our present practice in other stations, each 27-kv distribution feeder is equipped with a ground and test switch which will make it possible to ground and to connect the feeder cable to a substation test bus. By means of these switches, and a grounding air-blast circuit breaker, a single-phase ground or a 3-phase ground may be applied for the purposes of de-energizing a live feeder and for applying high voltage tests.

A working ground can be applied on the feeder with the ground and test switch equipment, thereby releasing the test bus for use on other feeders. Key interlocks are used to prevent improper operation of the switches and breakers.

The four test buses, each associated with a section of feeders, can be connected one at a time to a common test bus in the kenotron test room. The kenotron equipment is rated 62.5/250 kv.

Feeder Cables

Single-conductor 27-kv gas-filled cables are used for the distribution feeders, and high-pressure pipe-line type cable system is used for the 132-kv tie lines.

The pipe-line cable circuits consist of three single-conductor 1,500,000-cir mil cables, each insulated and shielded and pulled into an 8-in. steel pipe which is filled with cable oil. The oil pressure is maintained at about 200 psi. Protective equipment on the oil pipes and at the oil reservoir tanks provide alarm in case of an oil leak. The pipe is buried directly in the ground and requires no duct system. The pipe will be maintained at about 2 v negative with respect to earth potential to prevent corrosion. Special potheads suitable for high oil pressure operation are used at the line terminals.

In regard to insulation level, all 132-kv equipment is standard 138-kv class with an impulse-withstand level of 650 kv. Each 132-kv bus section is equipped with two sets of 121-kv lightning arresters so located that the maximum distance from a lightning arrester to equipment or cable terminals is about 150 ft. We believe that this plan will limit the impulse levels, in case of lightning strokes, to voltages below the rating of the equipment in all cases. Consideration was given to the use of steel poles around the station to protect against direct strokes, but in view of the relatively low height of the station and the protection offered by the lightning arresters, it was decided not to use this method of protection.

Switching surges are expected to be low. The recovery voltage rate when interrupting 132-kv feeder faults is estimated to be less than 2,000 v per micro-second. Arc-restrikes, when interrupting cable charging current, might cause voltage build-up on the cables, of several times normal voltage, but since the 138-kv circuit breakers are equipped with interrupters having resistors to raise the circuit power factor, we expect that no restrikes will occur. In the event a restrike should occur, the maximum voltage surge on the cable will be limited to not more than twice the normal peak voltage. The charging kva on the Hudson Avenue-Jamaica 138-kv cables is of the order of 30,000 kva each.

Insulation level of the 27-kv buses and the associated circuit breakers is that of the standard 34.5-kv class. The 27-kv circuits from the outdoor transformers are in metal-clad bus runs. The bus may be subjected to small voltage impulses, due to switching, but so far we have had no adverse effects from this cause at other 27-kv switching points.

Auxiliary Services

The station a-c auxiliary supply is served at 120/208 v. The power supply is taken from two 500-kva network transformers each supplied by a separate 27-kv distribution feeder from Jamaica substation. In addition there is a cable connection to the street low-voltage network.

A 48-v d-c supply will be used to initiate control functions from the control room. A 125-v d-c power supply will be used for control. Each system is backed by two storage batteries and chargers.

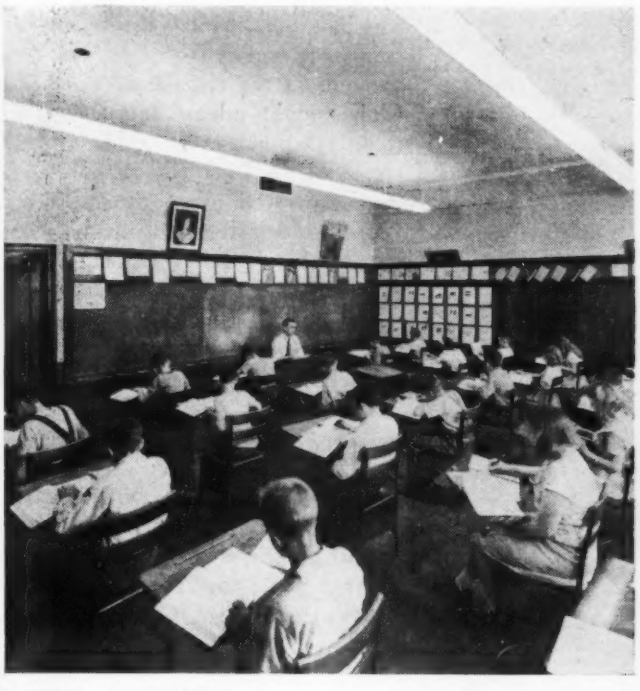
Fire Protection

Heavy fire walls are used around three sides of each of the 50,000-kva transformers. No special barriers are built around the high-voltage oil circuit breakers but the transformers are protected from them by their own fire walls. The physical spacing between circuit breakers is considered adequate for protection against a fire in one of these switches.

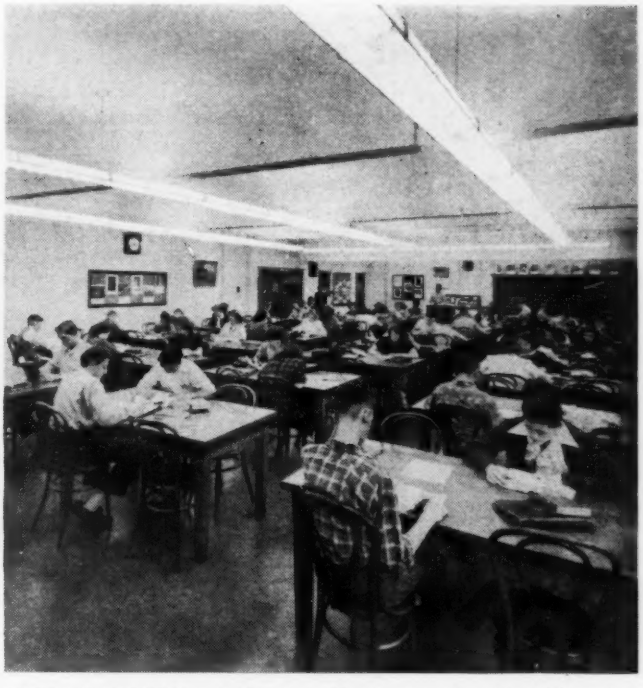
No isolation barriers are provided between switching equipment in the 27-kv switching room. The only oil-filled apparatus in the room is the bus potential transformers. These units are metal-enclosed and if a failure should occur it is unlikely that other completely metal-enclosed equipment in the switching room would be involved before the fire could be brought under control.

Relaying

The protective relaying is designed for high speed clearing of both 132-kv and 27-kv short circuits. Pilot-wire protection is provided on the 132-kv cable circuits to Hudson Avenue station and to the Valley Stream Substation of the Long Island Lighting Company. The pilot-wires are specially leased telephone circuits. The relay time for both phase and ground faults will be about two or three cycles. The 138-kv breaker time is 5 cycles, thereby giving 0.15 sec or less clearing time for high voltage feeder short circuits. Backup protection is provided by means of reactance-type phase relays and directional ground relays. Each section of the 132-kv and 27-kv buses is provided with high-speed differential protection. The 27-kv feeders use high-speed impedance relays and ground relays for 27-kv cable short circuits. Overcurrent relays and current-phase-balance protection are provided for backup on feeder faults. Backup overcurrent relays in a "partial differential" arrangement are used on the group bus supply breakers. These assure clearing 27-kv short circuits in case a feeder circuit breaker should fail to operate properly. The step-down transformers are protected by differential relays that operate in the order of 0.1 sec.



HARDLY A SHADOW in the sixth-grade classroom of the Washington School, thanks to the modern lighting

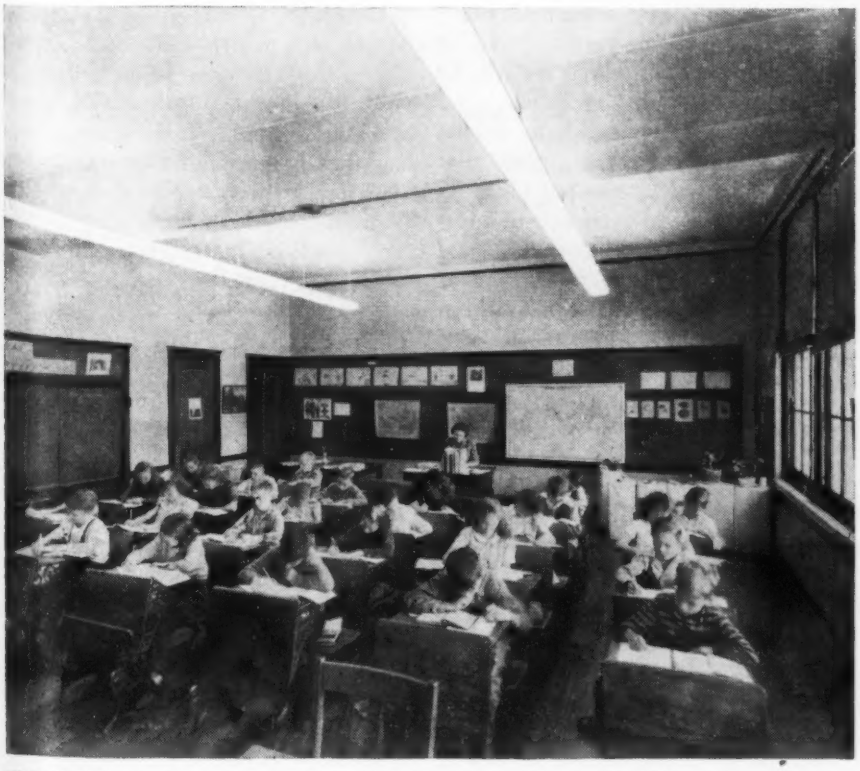


EVEN PATTERN of glareless illumination in the high school library eliminates eyestrain and fatigue

Complete Relighting Sold To Schools

Power company reduces rate for school lighting, brings improvement within compass of available operating funds

CARL LIEBIG
Commercial Engineer
Kansas Gas & Electric Co
Pittsburg, Kan.



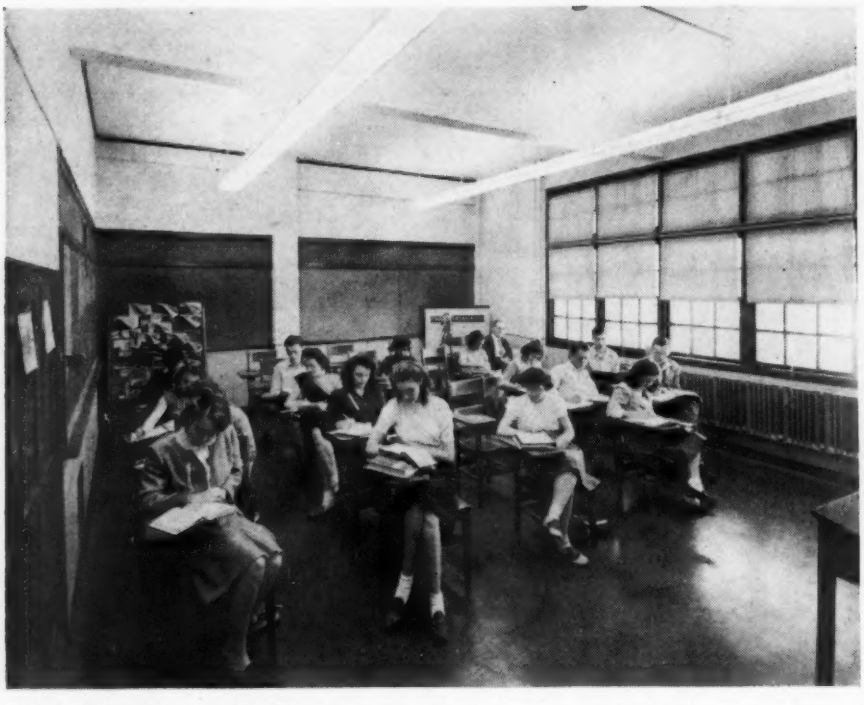
FORMERLY, a single center unit merely relieved the gloom in the fifth-grade room of the Eugene Field School. Now, good lighting aids both teacher and pupils

DURING THE 1947 summer vacation, 10 Pittsburg (Kansas) schools were completely relighted. Also a program of redecoration was started to raise light reflection factors, which had been as low as 15%.

Early in 1946, the power company had put into effect a new school lighting rate. The change was from the standard demand type rate to a flat charge of 2¢ per kwhr. Under the new rate, the Pittsburg schools could increase energy consumption by 70%, obtaining an additional 120,000 kwhr annually at no increase in cost.

For several years the Pittsburg School Board had wanted to improve lighting conditions. They were obviously bad. But the Board was faced with the same difficulty that confronts so many other school boards. It did not have the money to pay for the improvement. Tax levy limitations said "No."

Therefore, when the rate change was announced, the Board was not hard to sell on modern lighting.



WITH MODERN LIGHTING, the window shades can be used for their proper purpose of tempering the light in this Senior High classroom

The power company purchased the film, "Light Is What You Make It," as the first step in promotion of school lighting under the new rate. The Pittsburg Board was shown the film in the local power company office. The effect of the new rate was explained. The Board saw much of its difficulty melting away when it was told that what it had been paying for 171,350 kwhr in school lighting electricity would now buy 294,000 kwhr.

Getting Results

A simple demonstration clinched the sale. It was based on actual conditions in a typical Pittsburg schoolroom, 24 ft wide, 30 ft long: A single, bare 150-w lamp in the center; ceiling of medium dark color with reflection factor of about 30% instead of the 85% recommended; light intensity of 48 ft-c on the outside row of seats near the windows, one ft-c on the inside row. In the room where the Board met, the lighting intensity was reduced to one ft-c by means of a rheostat. Then the members were asked to read from some of the school text books. That did it.

The Board immediately borrowed a light meter and the members made their own investigation of lighting in the schools in their charge. As a result the power company was asked to prepare an estimate of cost of bringing the level of lighting in all 10 school buildings up to modern standards of quality and quantity.

A major cost item in the estimate was re-wiring. As many as five classrooms were on one branch circuit, carried in ½-in conduit embedded in concrete. New recommendations required at least one circuit for each room. The cost of re-wiring might have been prohibitive but for No. 12 synthetic thin-wall insulated wire. This wire made it possible to use the original conduit for the circuits and feeders. The estimate called for $75,000 to cover re-wiring and purchase of new equipment. It was hoped this amount would leave some over for further lighting of corridors, but at the time of the estimate, costs of equipment, materials, and installation were bouncing so rapidly that no guarantee of a surplus could be made.

Supt Lowell A. Small had urged better lighting from the beginning of his regime. He utilized every force at his command in aid of the $75,000 bond issue which the Board decided to present to Pittsburg citizens. Mr. Small and every member of the Board went on tour of the PTA groups to present the facts. Teachers, who had been working in the schools' dim areas, were particularly helpful in getting the facts before pupils and parents. One very effective means was handbills printed in the schools' print shop and delivered on doorsteps throughout the city. The local Lions Club bought advertising space and told Supt Small to write his own ad. On April 1, 1947 the school bonds were approved by a 3 to 1 victory.

Intense activity prevailed throughout Pittsburg schools between June 1, the end of the school year, and the beginning of the fall term, Sept 8. On the opening date every room greeted the delighted pupils and teachers with rows of light where formerly one bulb or dim enclosed fixture had tried to penetrate the gloom. Supt Small issued a bulletin about operation of the new lights emphasizing that "lights are there to be used" and he warned against unnecessary switching because of its effect on lamp life.

Cooperation of the suppliers and careful supervision of installation brought the total cost to $58,000 for fixtures, installation, and wiring. The remainder will go into the lighting of corridors, toilets, dressing rooms, and other secondary areas. And it appears there will be some left for germicidal lamps.

As of now, 167 rooms have been relighted. About 1,750 new lighting units have been installed. The general scheme is two continuous rows of Wakefield "Grenadier" fluorescent fixtures, each containing two 40-w lamps. Intensities are 30 ft-c in classrooms, 60 ft-c in study halls, and 100 ft-c in the printing and woodworking manual training shops, where industrial type units are installed. The horizontal cutoff angle to reduce glare is 25 deg lengthwise and 35 deg crosswise in the classrooms.

Only the Beginning

Pittsburg is the only city in KG&E service territory that so far has gone all the way in re-lighting its schools under the new rate. Results in Pittsburg show what can be done where improvement in school lighting is hindered or prevented by tax limitations. KG&E cut the Gordian knot by cutting rates. The benefit from a rate cut in service to schools is probably greater than in any other class of business. Proper visibility in schools can help greatly to create among the coming generation an appreciation of the value of power company service. That was the reasoning behind the rate cut.

ALUMINUM ROLLING MILL has 60,000 kw of connected load all served by aluminum buses and conductors

Aluminum Conductors Used Exclusively Throughout New Rolling Mill

Bare and enclosed bus, power cables, control circuits, substation structures, much conduit—all aluminum . . . Innovations are a low-reactance, high-current 3,500-ft bus and mill feeders in roof truss mounting

CONDUCTORS EXCLUSIVELY of aluminum, were installed for the power, control and lighting circuits of the new 50-acre aluminum rolling mill of Aluminum Company of America at Davenport, Iowa. The reasons go deeper than the natural desire of producer to use his own products in his own production plants. First, at the time the installation was started, there was a definite price advantage on the side of aluminum. This price advantage is even more favorable to aluminum at the present time. Second, there was a critical shortage of copper. Third, there was the availability of new and greatly improved means of making connections and terminations of the heavier aluminum conductors used in industrial electric systems. Fourth, and by no means last, was the desire to build the mill in the most modern manner.

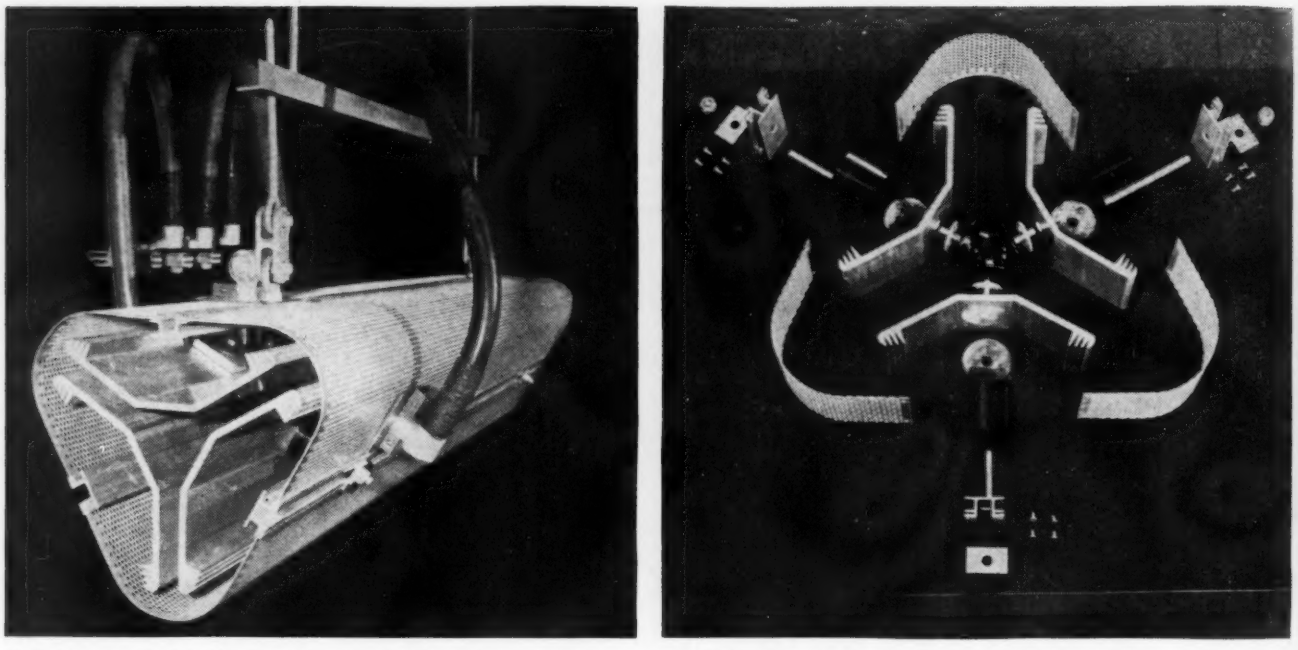
In the face of these positive encouragements, the traditionally conservative attitude of the company found ample justification for going "all out" on aluminum not only as a conductor material but also as a material for conduits, substation supports, bus enclosures, feeder troughs, etc. Both bare and insulated conductors are used. A novel low-reactance arrangement was developed for the 3-phase 3,500-amp 440-v bus runs to serve the heavy loads of the 3,500-ft rolling mill. Tap and branch circuits bring the total of this new design bus up to 6,000 ft. It has about 40% of the equivalent reactance of three conventional 7-in. channels in square configuration and 12-in. centers, phase-to-phase.

Load and Supply

The mill has 500 miles of general power and lighting circuits of all voltages with 76 miles in aluminum conduit. Connected load totals 60,000 kw (at 1.0 power factor) and the actual demand is expected to amount to 30,000 kw. This will be served from the adjoining Riverside plant of Iowa-Illinois Gas & Electric Co which is having a 40,000-kw turbogenerator added to increase its capacity.

Main power supply for the mill site consists of two circuits at 13.8 kv which are tied together at the remote end to constitute a loop. The two "sides" of the loop are carried vertically on opposite sides of steel towers. Each phase of each circuit consists of two conductors in parallel, supported in close proximity in parallel groove clamps; the conductors are 1,033,500 cir mil stranded all aluminum cable. (Not ACSR)

Tapped off the 13.8-kv loop are



SPECIAL 3-PHASE 440-v bus has about 40% of the equivalent reactance of 3 conventional 7-in. channels on 12 in. centers

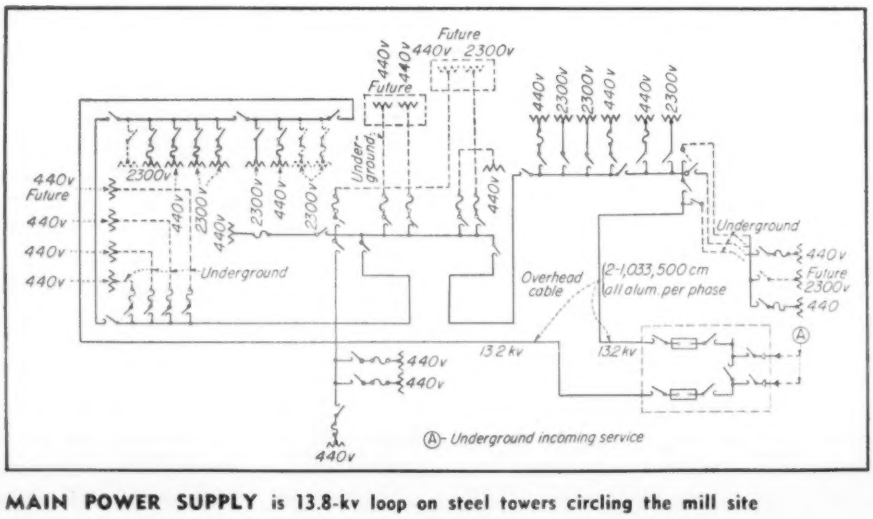
nine principal points of supply; outdoor substations built entirely of aluminum structural shapes and having aluminum bases for the standard disconnect switches.

The indoor substations are fed from the 13.8-kv lines by single-conductor, shielded aluminum cable with oil base insulation and Neoprene jacket. The shielding tape used in this cable is also aluminum. Sizes are No. 1/0, No. 4/0 and 750,000 cir mils. All connections and terminations on these conductors were made with argon-shielded arc welds; no flux is required in this process. The argon gas envelope protects the bright metal during the welding process. Bolted surfaces of lugs are coated with Alcoa Joint Compound. Where the lugs are installed outdoors or are exposed to corrosive influences, they were also protected with No-Ox-Id after completion. It should be specifically noted that copper to aluminum connections are made in the usual manner, with no special treatment needed despite dissimilar metals. Steel-cupped type of spring washers are used on terminals and connections on large cable to insure high pressure at the joints.

2.3 Kv System

Motors larger than 1,000 hp are 2,300 v synchronous machines. Each is fed directly from an appropriately sized transformer connected to the 13.8-kv loop through fues and disconnect switches. Breakers are unnecessary on the 13.8-kv side because a secondary breaker is part of the starting equipment for the motors. These large motors are the driving motors of the motor-generator sets which supply the d-c motors on the roll stands.

The 2,300-v radial circuits from the several outdoor substations are of 1,000,000 and 1,250,000 cir mil stranded (Class C) aluminum with oil base insulation and Neoprene jacket. No shielding tape is used for this voltage. As with the 13.8-kv circuits, these conductors have argon-welded connections and terminations. Splicing was kept in all instances to an absolute minimum by ordering the cables cut to the specified lengths. Some of the runs are carried in aluminum troughs, some in aluminum ducts; those in underground runs are in Transite ducts.

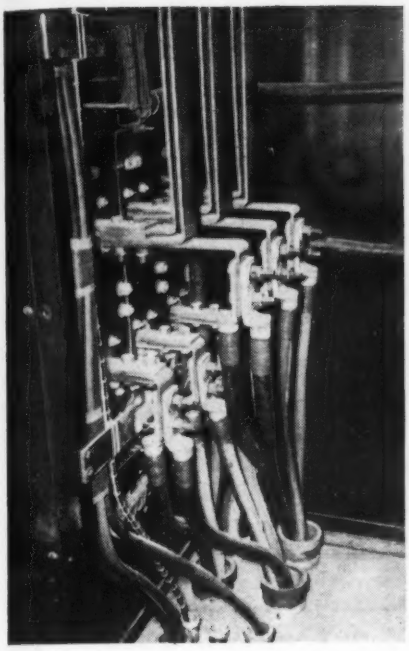


MAIN POWER SUPPLY is 13.8-kv loop on steel towers circling the mill site

440-V Distribution

There are fourteen substations of the outdoor and indoor types supplying the 440-v system from the primary 13.8-kv supply. Some of the outdoor substations supply both 2,300-v and 440-v on the same aluminum structures. The indoor substations are of the unit type with air circuit breakers and dry-type transformers.

The 440-v plant load is distributed throughout the entire plant with concentrations in the vicinity of the mills proper. The mills are located at in-



CUT-TO-LENGTH, 440-kv cables with argon-welded lugs join switchgear

tervals on a straight line. Service buildings, which are treated as concentrated loads, are arranged as laterals to the main buildings. It was desirable to be able to supply any reasonably large load at any point throughout the length of the main or service buildings. This provides flexibility for servicing all of the original or any new additional loads. The distribution system provides this flexibility without major changes. All loads of 1,000 hp or smaller are considered desirable for the 440-v system.

Low-Reactance Bus

The main conductor of the 440-v system is a low-reactance bus of new sector or triangular design, the objective of which is to bring the three phases into as close proximity as is compatible with adequacy of separation of the conductors. In this design each of the three conductors is an extruded aluminum shape (sector) with 120-deg "wings", each having 4 fins at the outer edges for heat dissipation. The central web of the sectors forms a triangle in which, at intervals, are 3-legged bakelite insulators. Other bakelite insulators support an enclosing perforated aluminum shield which makes the whole an enclosed bus. The sectors are made in 40-ft lengths and bolted together by plates.

Reactance of this compact bus arrangement is only 40% of that of a bus consisting of two 7-in. channels arranged in hollow squares for each phase with phases at 12-in. centers. A 2,500 amp bus of similar design is also available. For circuits of considerably smaller ampere rating it is possible to reduce the central flux-carrying region still further by merely using three v-shaped sections. When this can be done, the reactance is reduced another sixth, i.e. to one-third of the value for the square channel configuration. Full exposition of the design and characteristics of the sector bus were given in an AIEE paper entitled "Features of a New A-C Bus Design" by R. N. Wagner at the winter meeting, January 26-30.

Roof-Truss Mounting

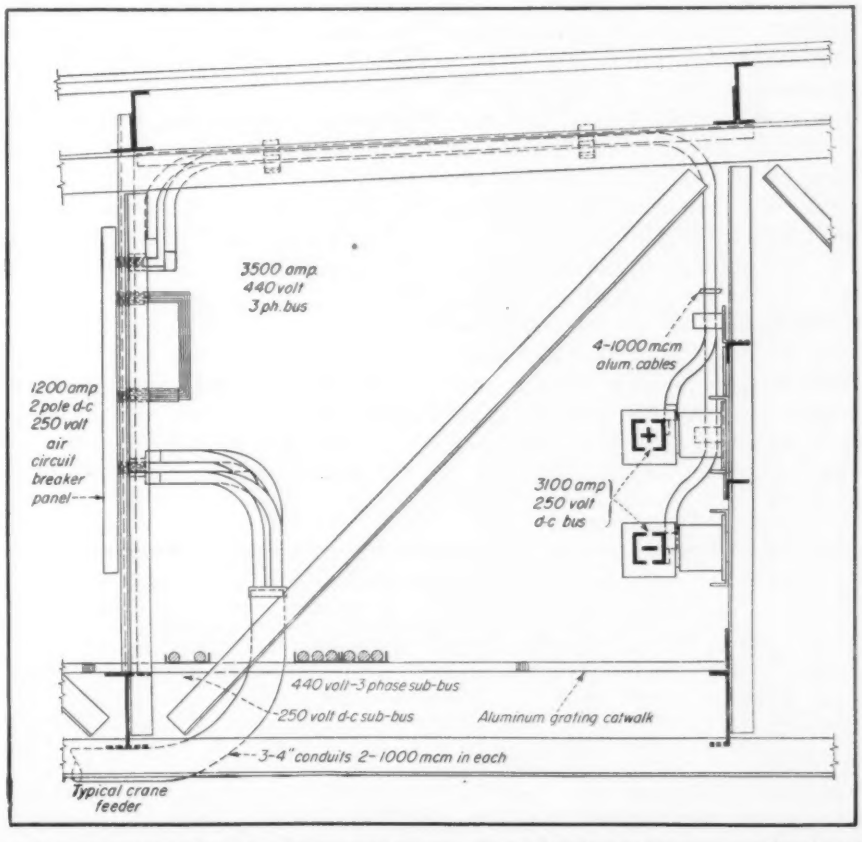
The bus structure is hung vertically from the roof trusses. Natural ventilation is obtained by having one of the three openings between the sectors located at the bottom of the structure.

Special 800 and 1,600-amp lugs with 30-deg take-off permits tapping any phases at any point between insulator assemblies. Feeds from the 440-v transformers to the main bus are also of the sector design.

In contrast to customary steel-mill practice which employs underfloor duct or tunnel distribution, the 440-v feeders and bus in this plant are carried on the roof trusses. A cat-walk, supported by the roof trusses, with about 7 ft of headroom is provided along the entire length of the building. The installation of the sector and d-c busses at this location affords the opportunity for change, inspection and maintenance—all unimpeded by the operations on the floor and provides increased safety.

The d-c run is tapped at points other than where the 440-v bus is tapped. This is done to avoid congestion of laterals and vertical runs. Expansion joints, made of thin, laminated aluminum sheet, are placed at necessary intervals.

Clevis-clevis type hangers further provide for the movement that arises from differential expansions of bus and building. These hangers are at 20-ft intervals and consist, in addition to the double clevises, of an eyebolt for attachment to the roof-truss and an eyenut for the stud at the top of



LOW REACTANCE bus hung from roof trusses. Catwalk with 7-ft headroom entire length of building affords access to both a-c and d-c buses

the triangular bus assembly used.

The 600-v cable used for the 440-v system has oil-base natural-rubber compound with Neoprene jacket on sizes of No. 8 and larger. The No. 12 and No. 10 aluminum conductors are solid wire with 9 mils of rubber and 9 mils of Neoprene, and with 5 mils of nylon jacket.

250-V D-C System

There are approximately 2,000-kw of 250-v general d-c plant load distributed in the mill. This consists mainly of traveling crane motors and various d-c driven machines, including auxiliaries on all mills. The load is served by a 3,500-ft 4-in. double aluminum channel bus run on the cat-walk paralleling the 440-v sector bus. This bus, of 3,100-amp rating, is fed at load concentration points by six motor-generator sets, two of which are 500-kw and the remainder of 300-kw capacity. Connections between motors, switch gear, generators and bus are aluminum cable in aluminum conduit with two to five cables per leg of 500 Mcm to 1,000 Mcm as the current indicates. The 1,000 Mcm is the largest 600-v cable used. The motor-generator sets are driven by 440-v synchronous motors designed to operate at 80% leading power factor. Similar synchronous motors are located so as to eliminate any need for capacitors to correct over-all plant power factor.

All taps from the d-c bus to circuit breakers on feeders or sub-buses are made with open cable. Smaller loads are taken from sub-buses which are run in aluminum cable troughs on the floor of the cat-walk paralleling the main d-c bus. Larger loads have their own circuit breaker and serve loads directly through cable in aluminum conduit. All large d-c cable is insulated with oil base compound with a Neoprene jacket.

Open cable bus is run in the roof trusses to serve those portions of the plant not easily reached from the main d-c or a-c buses. It is installed on porcelain insulators and dead ended with very light strain on the cross trusses. These cable buses, varying from one to three 1,000 Mcm per leg, are fed either directly from substations or from the main bus in a network arrangement with all points of connection to power sources being made through air circuit breakers.

Control, Signal, Lighting Circuits

Control circuits, public address and paging systems, time-clock circuits (in fact all but the telephone wire installed by the telephone company) are of aluminum conductors. For control, the wiring is No. 12 7-stranded with 9 mils of rubber and 12 mils of Neoprene, and with 5 mils of nylon jacket. This differs from the insulation on the solid-wire No. 10 and No. 12 power and lighting circuits in that the later have only 9 mils of Neoprene. In all cases, the nylon jacket is applied by extrusion. Stranding is used for No. 8 and larger sizes.

Lighting in the high buildings is provided by a staggered arrangement of 750-w incandescent and 400-w mercury-vapor lamps at 35-ft mounting height and 3,000-w mercury-vapor lamps at 50-ft mounting height. Fluorescent lighting is used for lower mounting heights and in the offices and inspection areas. All lighting cable is aluminum with insulation as described above, except for the neutral, which is No. 10 bare solid aluminum.

Mill Drives

Power for the main mill drives is 600-v d-c, supplied through motor-generator sets. Individual transformers supply the 2,300-v power for the motors driving the motor-generator sets. Aluminum cable, insulated for 5,000-v, is used for all connections between the transformers, switch gear and motor-generator set motors. The d-c power is taken from the motor-generators to the mill drive motors by means of either aluminum channel, flat aluminum bars or a combination of channels and flat bars.

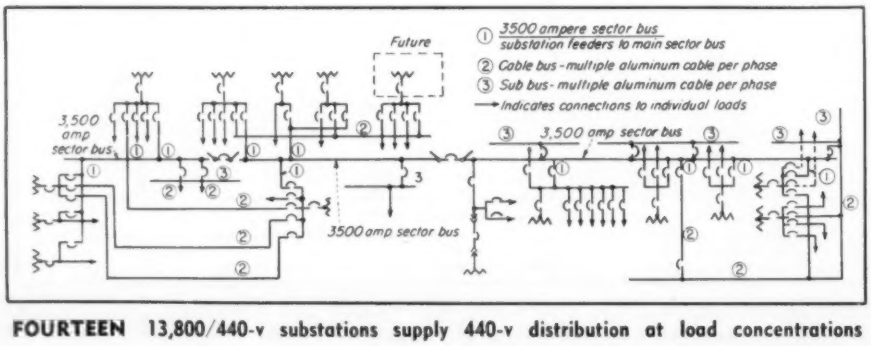
The bus connecting the two generators and the reversing mill motor, consists of two 7 in. aluminum channels and two $\frac{1}{4}$ in. x 5 in. flat aluminum bars per leg. The channels in each leg are arranged face-to-face so as to form a 7 in. open square with the openings at the top and bottom for good ventilation. The $\frac{1}{4}$ in. x 5 in. flat bars are inside the square with the bar against the web of each channel. Connections between this bus arrangement and the machine terminals and switch gear are made by means of four $\frac{1}{4}$ in. x 6 in. flat aluminum bars.

The main bus between the generators and the motors driving the continuous mill is made up of two 7 in. aluminum channels, one $\frac{1}{2}$ in. x 7 in. and two $\frac{1}{2}$ x 5 in. flat aluminum bars per leg. The two channels in each leg are back-to-back with the $\frac{1}{2}$ in. x 7 in. bar from each channel. This provides for good ventilation as well as rigidity. One $\frac{1}{2}$ in. x 5 in. aluminum bar is located between the flanges of each channel and is against the web. Connections between this main bus and the machine terminals and switch gear are made by means of six $\frac{1}{4}$ in. x 6 in. flat aluminum bars, with $\frac{1}{4}$ in. spacing.

Flat aluminum bars are used on all d-c buses for the cold mills and consist of three $\frac{1}{4}$ in. x 4 in. bars spaced $\frac{1}{4}$ in. apart per leg.

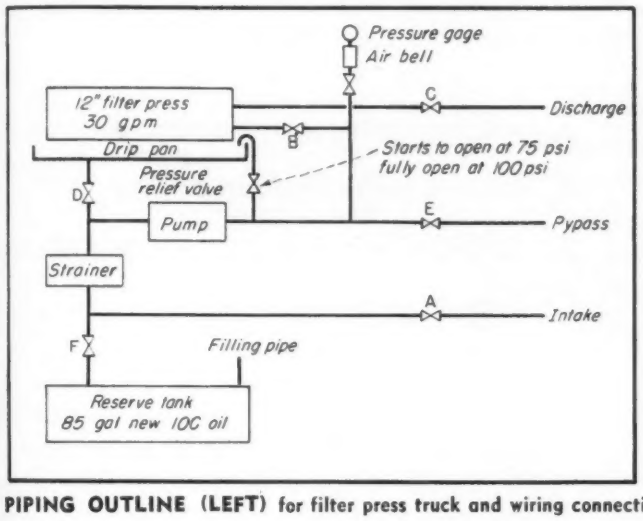
Aluminum Rigid Conduit

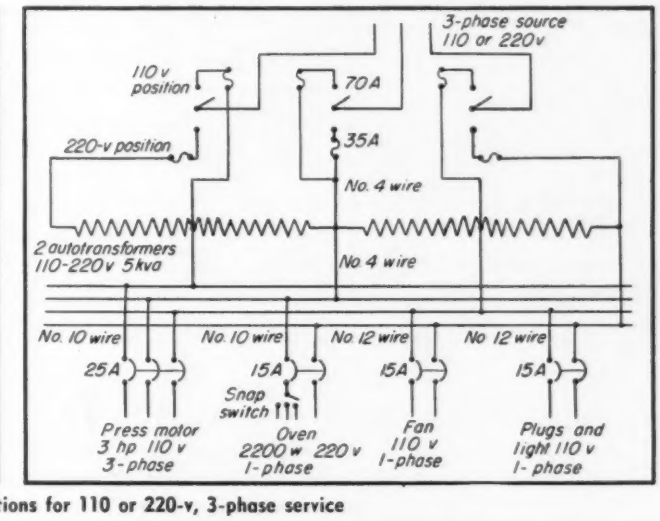
More than 76 miles of aluminum rigid conduit, varying in size from $\frac{1}{2}$ in. to 5 in., was installed throughout the plant. It is used for all voltages and is run exposed, through concrete, through underflooring, and in foundations. Aluminum rigid conduit, being non-magnetic, gives noticeably better voltage on the larger sizes of cable. Standard installations practices were followed in the use of aluminum conduit. An increased "hook" or "rake" made the threading dies self-cleaning.


Future
① 3500 ampere sector bus substation feeders to main sector bus
② Cable bus - multiple aluminum cable per phase
③ Sub bus - multiple aluminum cable per phase
→ Indicates connections to individual loads
3,500 amp sector bus
3,500 amp sector bus
3500 amp sector bus

FOURTEEN 13,800/440-v substations supply 440-v distribution at load concentrations

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN





PIPING OUTLINE (LEFT) for filter press truck and wiring connections for 110 or 220-v, 3-phase service

Care And Handling Of A Filter Press Truck

INSTRUCTIONS FOR the operation and care of a filter press truck are adapted from the practice of an eastern utility. Careful adherance to these recommendations has resulted in increased safety and operational efficiency throughout the utility system on which they have been used. Piping and wiring connections are illustrated.

Operational Procedure

1. Immediately upon arriving within any electric station area, the truck is to be grounded by connecting the ground cable located in the right rear compartment to the station ground bus.

2. Check all electric switches and breakers that are within the truck body open.

The 3-phase electric power supply can be obtained by connecting the 3-conductor 100-ft drag cable located in the left front compartment to the station service source of supply. An extra 100-ft length of 3-conductor drag cable is located in the same compartment for use wherever it is necessary.

Also a receptacle with three exposed leads with terminals is stored in this compartment to permit the drag cable to be connected to the supply at stations where no plug receptacles are provided.

Before closing the main tpdt safety switch located in the truck body, the voltage of the station service supply must be checked to verify the voltage to be 220 or 110. A voltmeter mounted in the door of the safety switch and permanently connected to the supply is provided for this purpose. (Note: There are normally no provisions for using this equipment on voltages other than 220 and 110.)

Distribution Panel

After the safety switch is closed in the proper position, the individual units are controlled from the distribution panel. Each circuit on the distribution panel is normally controlled and protected by an overload circuit breaker.

Overload operation is distinguished from the manual operation by the position of the handles. Upon automatic operation, the handle assumes a position midway between the manual "on" and "off" position. Re-setting of the breaker is accomplished by moving the handle to the extreme "off" position. It is then ready for immediate closing.

3. Operations and valve positions. (Refer to above illustration.)

Normal filtering: Close valves F, D, E; open valves A, B and C.

To drain drip pan: Open valve D.

To by-pass for direct pumping: Close valves F, D, B and C; open valves A and E.

To draw from reserve tank: Open valves F, B and C, with valves A, D and E closed, or open valves F and E being sure that valves A, D, B and C are closed.

4. Use reserve tank for new 10C oil only.

5. Used blotters or discarded oily rags are not to be permitted in the truck. The reasons for this precautionary measure are obvious.

6. Clean rags are to be kept in the clean rag container only, here again for obvious reasons.

7. The truck and all equipment that is installed therein, is to be kept in a thoroughly clean condition at all times.

Fire Protection: A 2-lb CO_2 fire extinguisher is provided (mounted within the truck body) for any small fires that may occur.

GENERAL ELECTRIC REPORTS ON RECENT IMPROVEMENTS

1. ***All ratings now Spirakore* design***
2. ***Sealed tanks prolong oil life***
3. ***Shielded windings, 22 kv and above***
4. ***Improved Pyranol insulating liquid***

The best distribution transformers that General Electri has ever built have been coming off our production line during the last few years. Furthermore, our productio rate has been, for several months, far greater than that o any comparable prewar period.

1. Now they are all SPIRAKORE

All General Electric single-phase distribution trans formers now use the Spirakore construction, one o the really fundamental improvements in transforme history.

The first Spirakore transformer, announced in 193 used a circular-shaped core, which decreased excitin current, permitted a radical reduction in size and weigh and resulted in lower prices. Later, a rectangular-shape core was developed, still utilizing the Spirakore desig and retaining its original advantages, but also permittin substantial improvement in impulse strength.

Basically, this method of winding cores from stee strip instead of assembling them from punchings pro duces a mechanically stronger core. Even more importan it produces a core in which the flux path is parallel wit the direction of the steel's grain. This permits, in turn the use of corisil, a cold-rolled, oriented-grain stee having superior magnetic characteristics in the directio of the grain. Spirakore transformers are small, ligh weight, have high impulse strength, and low excitin current.

**Reg. U.S. Pat. Off.*

IN DISTRIBUTION TRANSFORMERS

2. *They are SEALED to prolong oil life*

All General Electric Spirakore transformers above 15,000 volts use the sealed-tank construction. In the lower voltages, this design is already being used for most kva ratings.

The sealing of tanks for the purpose of prolonging the life of insulating oil has long been a feature of G-E power transformers. Now General Electric is making sealed tanks available, for the first time, in distribution transformers.

Outside atmosphere, with its harmful moisture content, is effectively sealed out by Buna-N rubber gaskets at all openings. These gaskets, compressed against stops or, in the case of the smaller transformers, against a deep-rolled flange on the tank, form a liquid-tight joint without use of cement or gasket stickers.

3. *They are SHIELDED against lightning surges*

All General Electric Spirakore transformers, 22,000 volts and above, have shielded windings.

Shielding was first introduced in the power-transformer field by General Electric in 1926. By preventing severe concentrations of voltages within the windings, the impulse strength of high-voltage transformers has been greatly increased and failures prevented. Now General Electric provides shielding in distribution transformers in the higher-voltage ratings.

High- and low-voltage coils are concentric with each other, and with the grounded core. Insulated metal shields around the coil are connected electrically to each line lead. Surges, which otherwise might produce tens of thousands of volts between adjacent layers and turns, are so distributed as to produce only a few thousand volts—stresses which the new progressive-layer insulation can easily withstand.

4. *They are supplied with an improved PYRANOL**

All General Electric Pyranol-filled transformers are now supplied with an improved Pyranol, designated as No. 1467.

Pyranol is an insulating liquid, introduced by General Electric in 1932, which permits, under the National Electrical Code, the indoor installation of liquid-filled transformers without fireproof vaults. It is chemically stable and possesses all the necessary operating characteristics of a good insulating liquid, but unlike mineral oil, it will not form explosive or flammable gases, *and will not burn, oxidize, or sludge.*

The chemical composition of the original Pyranol has been improved so that, now, equipment insulated and cooled with the new liquid can be handled in the same way, in case of failure, as would oil-filled equipment. The principal difference, compared to the older No. 1488 Pyranol, is that the new No. 1467 neutralizes the hydrogen-chloride gas remaining in the liquid after an internal arc. This avoids any possibility of the formation of hydrochloric acid within the transformer.

NOT A DAY'S PRODUCTION LOST

These improvements, and others, have been brought to you without causing a day's loss of production; furthermore they have been a major factor in limiting price increases. The high volume of production today is in great measure possible only because of savings in critically short materials and the use of new high-speed machines that are a part of the Spirakore improvement program. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

402-19

A Quick Way To Estimate Substation Costs

L. M. APPLEGATE
Electrical Engineer
Portland, Ore.

IN MAKING PRELIMINARY estimates of substation costs, it's often handy to have a way of making a rough estimate without preparing a complete design. The accompanying data and curves give some ratios of total cost to certain component costs that were derived from cost analysis of a number of actual substations.

In preliminary estimating, the number and voltages of circuits entering and leaving the substation is usually known, as are the interrupting ratings of circuit breakers, and the ratings of transformers and condensers. It is then possible to fix the probable delivered cost of these components. If a reliable ratio of total cost to component cost is available, the probable total cost of the complete substation can be estimated.

Substation Costs Vary

Accompanying tabulation gives the delivered costs of transformers, oil circuit breakers, and condensers and the total costs of 30 different substations. Substation costs vary from about $30,000 to $4,700,000. Line and transformer primary voltages include 66,000, 115,000, and 230,000. All the substations except one have some 115,000-v equipment, and all the larger substations also have some 230,000-v equipment.

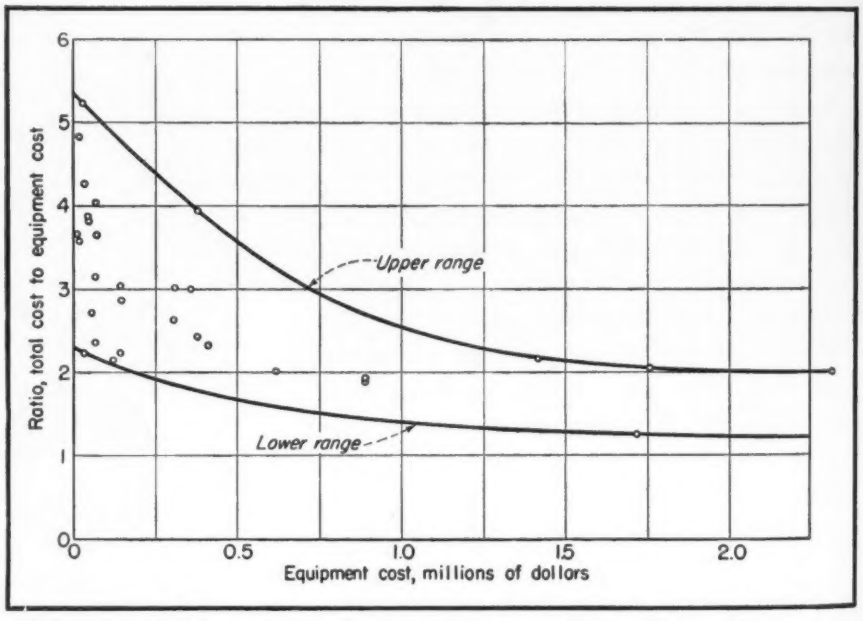
Equipment costs are the delivered costs of the bare items. Oil circuit-breaker prices include reclosing mechanisms but no accessories except those ordinarily included in the purchase of a breaker. Disconnecting switches are not included. Transformers include the usual accessories such as special cooling fans and tap changing equipment, either manual or under load as may be concerned in the particular station. Condensers include only the condenser, direct-connected exciter, and other accessories usually included as part of the condenser order. The oil circuit breakers for operating the condenser are included in the circuit breaker costs.

These substations were built in the Pacific Northwest during the period from 1938 to 1946. Costs in most instances do not represent the final development of the substations, but the construction represented is that of a completely equipped station for normal operation. Bus arrangements are generally main and transfer with one oil circuit breaker per line or transformer and a bus tie breaker. Relay and control equipment, transformer towers, and control houses are adequate but not elaborate. Variations in costs among substations in the same price class are attributable more to variables due to special local conditions rather than to differences in design. These factors are naturally more noticeable in small substations than in large ones.

Ratios of total cost to equipment cost appear to approach 2.0 for these 30 substations as the sizes of the stations increase. Even for small substations this ratio is feasible under

Ratio of Equipment Cost to Total Substation Cost

Station No.	Cost, thousands of dollars					Ratio, Station/ Equipment
	Transformers	Circuit breakers	Condensers	Total Equipment	Total Station	
1	1,056	404	262	1,722	2,221	1.29
2	574	318		893	1,705	1.91
3	511	286	102	898	1,744	1.94
4	418	202		620	1,248	2.01
5	1,281	693	344	2,318	4,692	2.02
6	916	496	343	1,754	3,652	2.08
7	107	14		121	261	2.16
8	625	789		1,414	3,119	2.20
9	24	3		27	60	2.22
10	143			143	321	2.23
11		437		437	1,028	2.34
12	69	9		78	187	2.38
13	154	235		389	950	2.44
14	29	2		31	81	2.61
15	56	3		59	160	2.71
16		149		149	430	2.88
17	92	131	81	304	911	3.01
18	148	138	78	364	1,095	3.02
19	59	38	48	145	441	3.04
20	55	24		78	246	3.15
21		19		19	68	3.59
22		9		9	33	3.66
23	61	12		73	268	3.67
24	41	6		47	182	3.87
25		37		37	144	3.89
26	132	128	124	385	1,523	3.96
27	43	27		70	283	4.05
28	11	19		30	128	4.27
29	18	2		20	97	4.84
30	11	17		28	146	5.23



RATIO OF TOTAL substation cost to equipment cost, including only transformers, circuit breakers and condensers. Curves cover upper and lower ranges of 30 actual substations

lamp-matched ballasts

All the power for a fluorescent lamp goes through the ballast. If the lamp is to deliver its full rated life and full light output, the ballast must be not "just a transformer," but an accurately made piece of equipment, with permanent electrical characteristics tailored to the voltage and current requirements of the lamp under both starting and running conditions.

General Electric, maker of lamps, ballasts, starters, cable and lampholders, is well aware of this interdependence. General Electric ballasts are designed, built, *and tested* for permanent, matched characteristics.

Losing Lumens?

The ballast can be the determining factor in the light output of your fixtures—G-E ballasts deliver all the light your buyers expect—every lumen of light the lamp is designed to give!

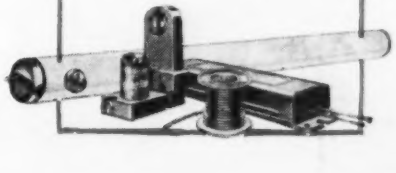
General Electric fluorescent ballasts are lamp-matched—engineered, manufactured, and tested to assure you full rated lamp light—for full rated lamp life—from all standard fluorescent lamps. Write today for bulletin GEA-4950.

Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

412-19

BALLASTS
CABLE
LAMPS
STARTERS
LAMPHOLDERS
for
DEPENDABILITY
in fluorescent lighting



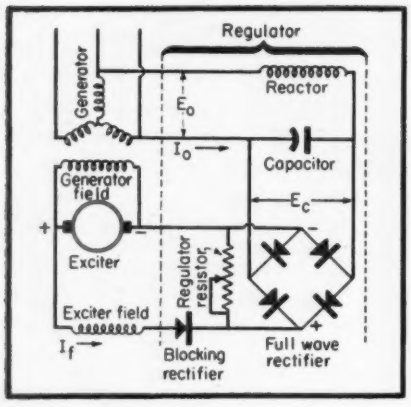
favorable conditions, although local conditions make an estimating ratio of less than 3 questionable. Ratios of 4 or more should not occur except under adverse conditions.

The substation showing a ratio of 1.29 was designed under war-time conditions to be as simple and economical as possible. The small substations giving ratios of about 2.2 also found to be exceptionally economical.

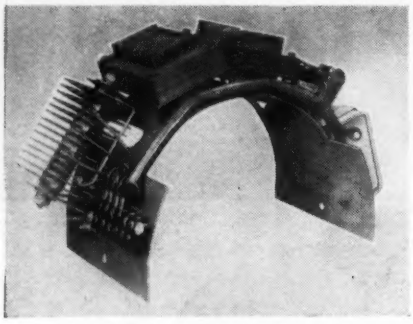
For quick estimating, a curve between the upper and lower ranges presented here can be drawn to conform to local practices. Although in the large stations the ratio of 2.0 was cut only in one instance, the existence of the one demonstrates the feasibility. For quick and reasonable estimates a curve through the middle of the field is justified, but for a liberal estimate, values only slightly lower than the upper range probably should be used where the local costs and practices are not accurately known.

• • •

Voltage Regulating Unit Built Into Generator



ELEMENTS of regulating circuit



ASSEMBLY OF regulating circuit components—rectifiers, reactors, resistor and capacitor—on a saddle

R. L. GOMON
District Manager
Electric Machinery Mfg Co
Detroit, Mich.

IN THE DEVELOPMENT of a voltage regulating circuit for a high-frequency (180 and 360-cycle) generator, use is made of the well-known phenomenon of resonance which takes place in a series circuit containing inductance and capacitance whose reactances are made numerically equal at the applied frequency. In the resonant condition, the voltage which develops across the reactor or the capacitor at a given frequency can be much higher than the a-c voltage applied to the series circuit comprising both the reactor and capacitor. Operating principle of the self-regulating generator is the amplification obtained when a-c voltage, E_o, from the generator is applied to the near-resonant circuit consisting of a reactor and capacitor in series.

As seen in the diagram, the voltage across the capacitor E_c, is fed to a full-wave rectifier. The d-c output of the rectifier is connected across the regulator resistor. and through a blocking rectifier to the exciter armature and field. Note that the polarity of the full-wave rectifier is such as to oppose the polarity of the exciter.

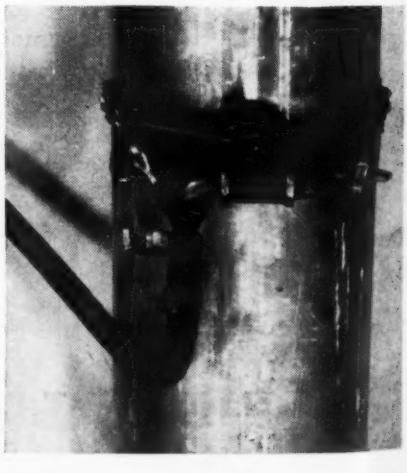
When the voltage of the a-c generator increases, the voltage across the capacitor increases in much greater proportion, and likewise the direct current produced by the full-wave rectifier. This rectified voltage opposes the voltage applied to the exciter field winding by the exciter, thus reducing the magnetic field flux of the exciter and the exciter voltage and, in turn, reducing the voltage across the field winding of the a-c generator and hence the voltage of the generator.

Conversely, when the voltage of the a-c generator decreases, the voltage produced by the capacitor through the rectifier decreases at a much greater rate thus decreasing the opposition to the exciter voltage, allowing the exciter voltage to increase and thus to increase the voltage of the a-c generator. The action of the circuit thus operates to control the a-c generator voltage and hold it constant.

The blocking rectifier permits flow of the direct current in the proper direction only. Its purpose is to prevent reversal of polarity of the exciter field current; this would injure the full-wave rectifier.

Gas Test for Cable Joint

A CONVENIENT GAS test for cable joints is used by the Boston Edison Co. As described by A. T. Hanson before the Underground Distribution Engineers of New England, the scheme work as follows: After the sleeve is wiped on the joint, it is subjected to 6 psi of CO_2. A small V-cut is made in the top of the sleeve near one wipe. The cut is later used as a filling hole. A rubber cup on the end of the tube from the gas tank is clamped over the cut. The gas pressure in the joint is adjusted to the above value, and the wipes are checked for leaks by applying soap suds



Quick Economical Attractive

G-E CAPACITOR EQUIPMENTS can be shipped in a relatively short time. Further, a 2520-kvar outdoor unit, such as pictured, is easily installed and can be in service helping you meet demands within 48 hours from the time it reaches location.

These equipments are neat, modern, attractive—are weatherproof, and have a superior weather-resisting paint finish. Each equipment is complete with Pyranol capacitor units with individual fuses, grounding switch and, where desired, air or oil breakers—with or without automatic switching. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

CAPACITOR EQUIPMENTS PROVIDE A PRACTICAL METHOD OF MEETING GROWING LOADS NOW.

G-E capacitors can help you deliver more kilowatts—right now, in a matter of weeks. This is true *even if the power factor of your system is as high as 95 per cent.*

And because they constitute the lowest-cost method of increasing the kilowatt capacity of generating plants, transmission lines and transformer banks, their importance in your long-range economic picture can hardly be overemphasized.

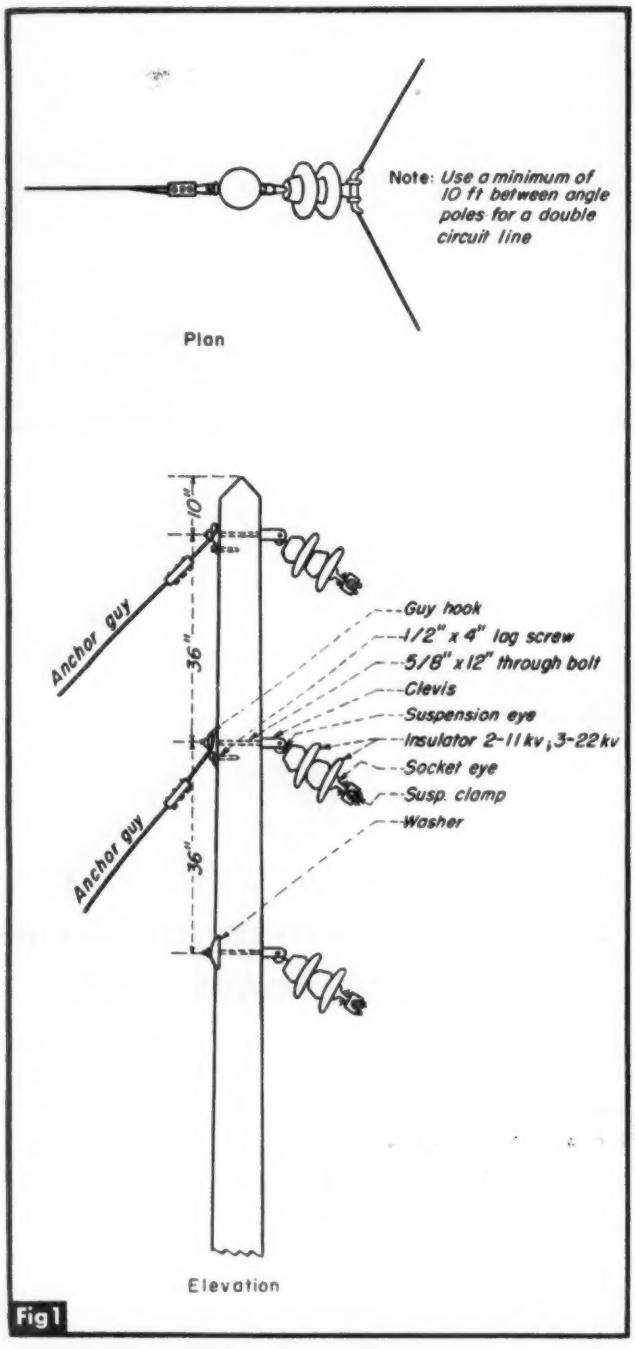
GENERAL ELECTRIC

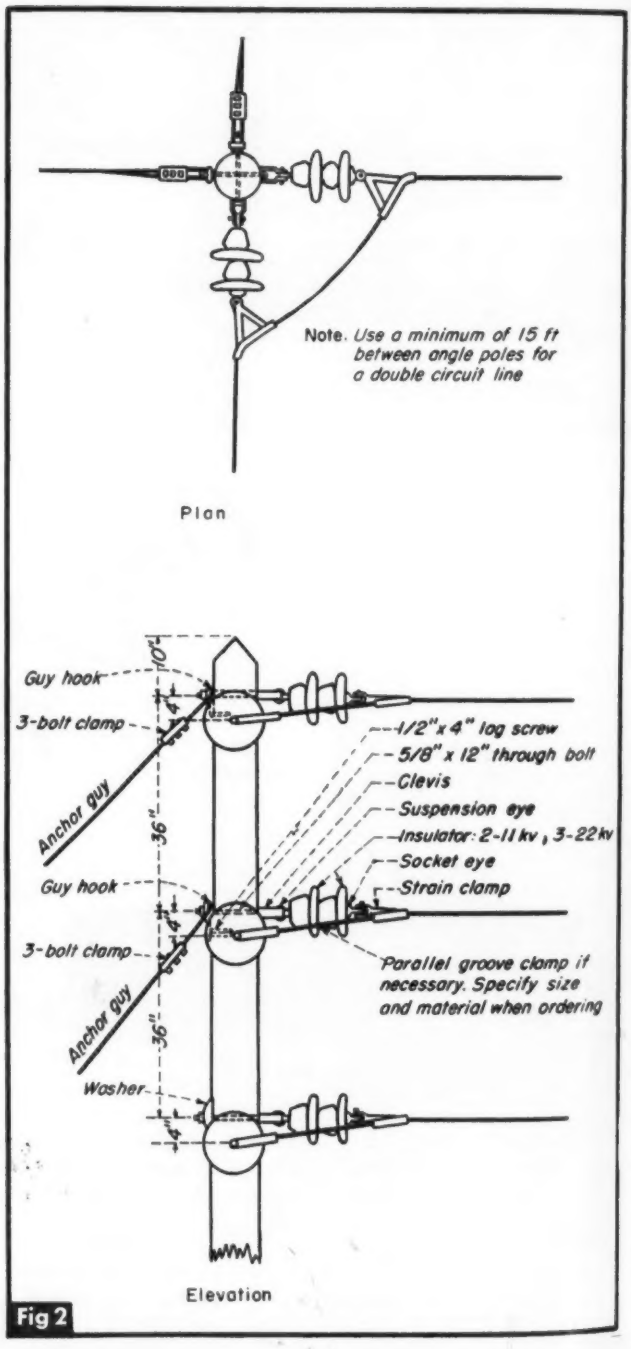
407-129

Angle Pole Construction For 11-Kv And 22-Kv Lines

Insulator arrangement for angles (Fig 1) from 30 to 60 deg and (Fig 2) from 60 to 90 deg

An adaptation from construction standards of Hartford Electric Light Co, Hartford, Conn.





Filled Bushings

are now in their 26th year of continuous service on a large southern system.

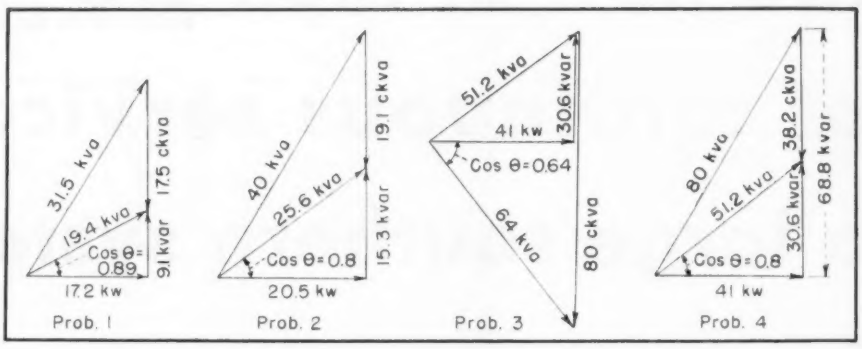
Performance like this is the soundest reason for making O-B your

BUSHING PREFERENCE

How to Calculate Power Factor Of Transformer Type Welders

Four problems and kva triangles exemplify determination of power factor of reactance-controlled welding transformers when operating under a particular condition of arc voltage and current

R. F. WYER
Electric Welding Division
General Electric Co
Schenectady, N. Y.



FOR the accompanying calculations, basic conditions are as follows: (1) Each a-c welding transformer has a fixed turn-ratio between the primary and secondary windings, and (2) accuracy is sufficient for most practical purposes, although transformer magnetizing current is not taken into consideration.

Problem 1—Find the power factor of a 500-amp, 75-v GE welding transformer with 17.5 kva of built-in capacitors operating at 420 amp with a 34-v arc.

$$\text{transformer input kw} = \frac{\text{amperes} \times \text{arc volts}}{\text{efficiency} \times 1000}$$

$$= \frac{420 \times 34}{0.83 \times 1000} = 17.2 \text{ kw}$$

$$\text{transformer kva} = \frac{\text{amperes} \times \text{open-circuit volts}}{1000}$$

$$= \frac{420 \times 75}{1000} = 31.5 \text{ kva}$$

$$\text{transformer lagging kvar} = \sqrt{(31.5)^2 - (17.2)^2} = 26.6 \text{ kvar}$$

Of this 26.6 lagging kvar, 17.5 kva is cancelled by the leading kva supplied by the capacitors.

Net lagging kvar = 26.6 — 17.5 = 9.1 kvar

Actual kva drawn from power line = $\sqrt{(17.2)^2 + (9.1)^2} = 19.4$ kva

$$\text{pf} = \frac{\text{kw}}{\text{kva}} = \frac{17.2}{19.4} = 89\% \text{ lag}$$

Problem 2—Find the capacitor kva that must be added to obtain a certain power factor for a given load on a transformer having no capacitors, such as a 750-amp, 80-v unit.

Assume welding is done at 500 amp, 37 v, and desired power factor of the single transformer with 80-v open-circuit voltage is 80% lagging.

$$\text{transformer kw} = \frac{\text{amperes} \times \text{arc volts}}{\text{efficiency} \times 1000}$$

$$= \frac{500 \times 37}{0.90 \times 1000} = 20.5 \text{ kw}$$

$$\text{transformer kva} = \frac{\text{amperes} \times \text{open-circuit volts}}{1000}$$

$$= \frac{500 \times 80}{1000} = 40 \text{ kva}$$

$$\text{transformer kvar} = \sqrt{(40)^2 - (20.5)^2} = 34.4 \text{ kvar}$$

For desired power factor of 0.8 lag, the kva drawn from the power line must be reduced to:

$$\text{kva} = \frac{\text{kw}}{\text{pf}} = \frac{20.5}{0.8} = 25.6 \text{ kva}$$

Then with 25.6 kva and 20.5 kw,

$$\text{kvar} = \sqrt{(25.6)^2 - (20.5)^2} = 15.3$$

Capacitor kva to be added = 34.4 — 15.3 = 19.1 kva. Actually 20 kva would be added since it is a standard rating.

Problem 3—Determine power factor for a group of welding transformers with conditions as in Problem 2, taking into consideration a welding duty factor.

Six such transformers operating on a 33-⅓% duty cycle (3-⅓ min under load in each 10-min period) would mean that at any instant two welders would be under load and four would be on the line but idle. For all practical purposes, the power factor of the idling transformers may be considered zero leading because the exciting kilowatts are so small in relation to the capacitor kva. Then power conditions are as follows:

Transformer	Kw	Kva	Kvar
(1) 500 amp 37 v, 0.8 pf	20.5	25.6	15.3 lag
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(5) No load	—	20	20 lead
(6) No load	—	20	20 lead
	41.0		49.4

$$\text{kva of group} = \sqrt{(41)^2 + (49.4)^2} = 64$$

$$\text{pf} = \frac{\text{kw}}{\text{kva}} = \frac{41}{64} = 0.64 \text{ lead}$$

Thus the addition of 20 kva of capacitors to each welding transformer actually supplies a considerable amount of leading kva available for power factor correction of other plant load.

Problem 4—Find capacitor kva that must be added to the bank of six transformers operated under the conditions of Problem 3 to get an over-all power factor of 0.8 lagging.

Transformer load conditions are as follows:

Transformer	Kw	Kva	Kvar
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	41		68.8

To have a power factor of 0.8 lagging for the group of transformers would mean that the kva drawn from the power line would have to be reduced to

$$\text{kva} = \frac{\text{kw}}{\text{pf}} = \frac{41}{0.8} = 51.2$$

Then with 51.2 kva and 41 kw,

$$\text{kvar} = \sqrt{(51.2)^2 - (41)^2} = 30.6$$

Capacitor kva which must be added = 68.8 — 30.6 = 38.2 kva.

In order to take full advantage of the capacitors added, it would be good practice in this case to add 45 kva of 3-phase capacitors to the feeder supplying the transformers and group the six transformers two per phase. Note that in any calculations such as the above, consideration is given to one condition of load on the transformer, when in reality the load on a single transformer or the total load on a group of transformers is fluctuating over rather wide limits. These fluctuations, however, will not reflect in the power bill since most demand charges are figured on a 15-min basis and integrating meters are used which will take an average condition during the period. For this reason, simple calculations, such as those illustrated above, may come quite close to the actual power factor of the installation as shown by power-measuring instruments.

ANSFORMERS

Modern Moloney 3-Phase Power Transformer, Rated 18,750 Kva, 115,000 to 13,800 Volts.

COMPANY

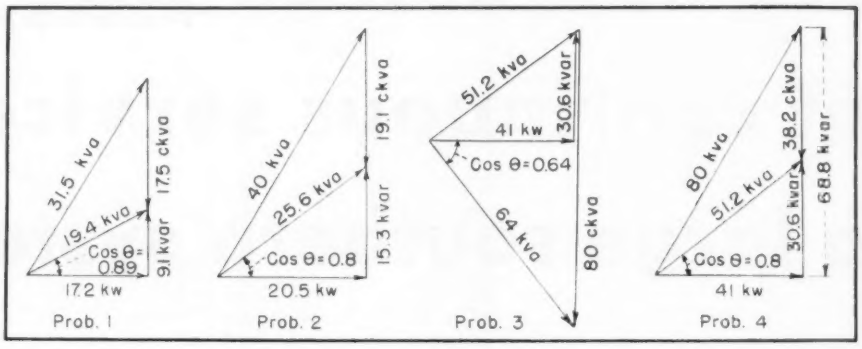
EXCLUSIVELY SINCE 1896

AND TORONTO, ONTARIO, CANADA

How to Calculate Power Factor Of Transformer Type Welders

Four problems and kva triangles exemplify determination of power factor of reactance-controlled welding transformers when operating under a particular condition of arc voltage and current

R. F. WYER
Electric Welding Division
General Electric Co
Schenectady, N. Y.



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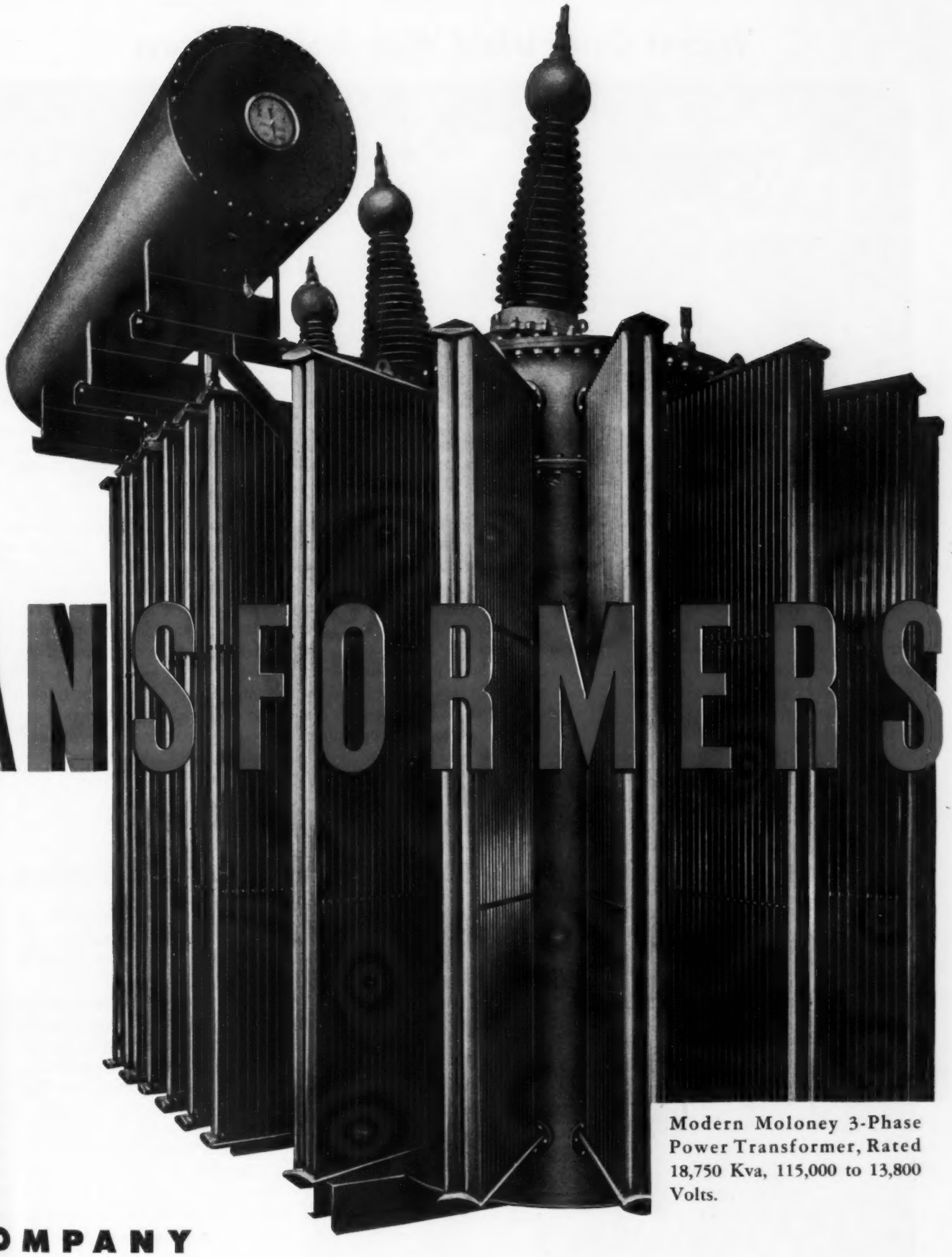

ANSFORMERS

Modern Moloney 3-Phase Power Transformer, Rated 18,750 Kva, 115,000 to 13,800 Volts.

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Wicket Gates Inlaid With Stainless Steel

SPECIAL WELDING JIG facilitates laying stainless steel on journals of wicket gates. After top and bottom journals are built up they are machined and polished to a high finish. Third set of 24 gates is presently being modified according to this rejuvenation technique. The gates are from the Hoover powerhouse unit

STAINLESS STEEL INLAY is expected to increase the life of this wicket gate from Hoover powerhouse unit of Los Angeles Department of Water and Power

STAINLESS STEEL inlays are being made on wearing surfaces of wicket gates from Hoover powerhouse units operated and maintained by the City of Los Angeles Department of Water and Power. As part of an extensive program of preventive maintenance, the gates are being modified with the aid of a special set-up in the shops of the Department.

Heel and toes seating surfaces are milled out and then built up again by welding with 18-8 (chrome-nickel) stainless steel. Shaft journals are turned down to sound metal and built up in special jigs as shown. The special welding set-up uses a variable speed drive to rotate the shafts about 4 rpm, with the weld being built from bottom to top. To set up the lower journal, the long upper end of the shaft is lowered into a floor pit. After the stainless steel is deposited, the shaft is machined to the proper diam and polished to a high finish.

This program was initiated over a year ago with modification of a set of 24 gates previous to general overhaul of one of the Hoover units. The set of gates from that unit was in turn modified and used in the next unit overhauled. The shop is presently working on the third set of 24. Although it is too early to evaluate from experience the merits of stainless steel surfaces for this service, greater resistance to wear and corrosion should add substantially to the life of these gates.

• • •

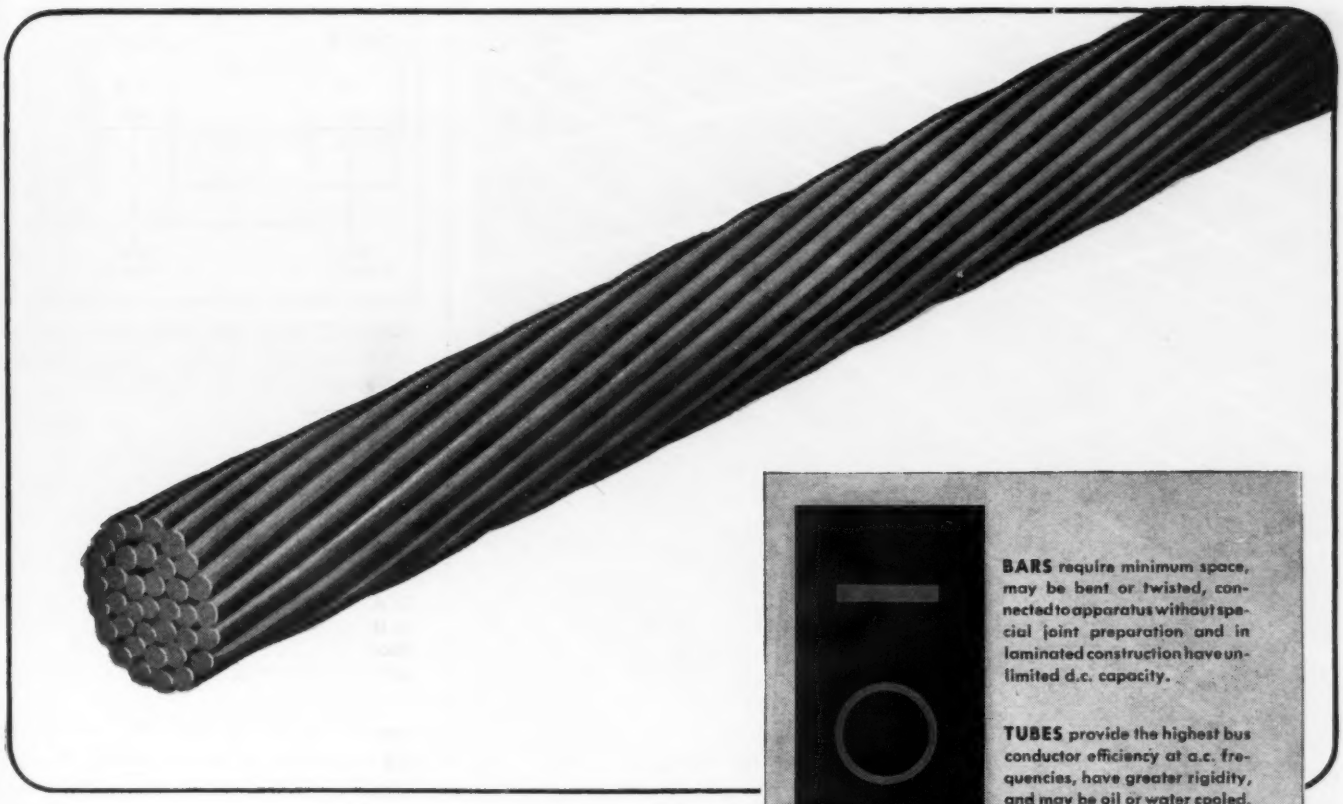
3-Way Oil-Disconnects Switch Underground Transformers

TWO 750-KVA BANKS supply 1,500-kva building load through network protectors. Oil disconnects in background accomplish desired switching

F. A. BOLIEN
Asst Supt Underground
Portland (Ore.) General Electric Co

SUPPLYING a new building load of 1,500 kva from two banks of 750-kva transformers, each with separate 11-kv underground primary feed, posed a switching problem for Portland General Electric Co. In case of loss of a feeder cable it was desired to feed both banks from the remaining good cable. This and other switching requirements could not be met by the usual single-throw subway-type oil switch. Solution was found in the G & W 3-way type RAL oil-disconnecting switches.

By using two switches connected as shown it is possible to energize each bank by closing the line switches to the transformer position, leaving the



BARS require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.

ANGLES for ventilated hollow busses have highest rate of heat dissipation, handle greater current density, but require more space for installation.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as furnaces of the arc or resistance types.

Copper Cables

. . . for heavy currents and flexibility in confined space

A BUS of cable connections is sometimes more convenient than the more rigid conductor shapes. One example is where extremely heavy currents are required in a confined area.

Flexibility is another advantage offered by cable conductors. They are used for this reason in connecting the main bus run to the electrodes of arc furnaces and resistance furnaces of high capacity.

Anaconda Bus Conductors are made in this and the four other standard shapes illustrated. Each is produced in a wide range of capacities, and all are made of *copper* . . . the bus conductor material that combines low electrical resistance, high thermal conductivity and high corrosion resistance with adequate strength. For detailed information, write for Anaconda Publication C-25. 47380

ANACONDA

Anaconda

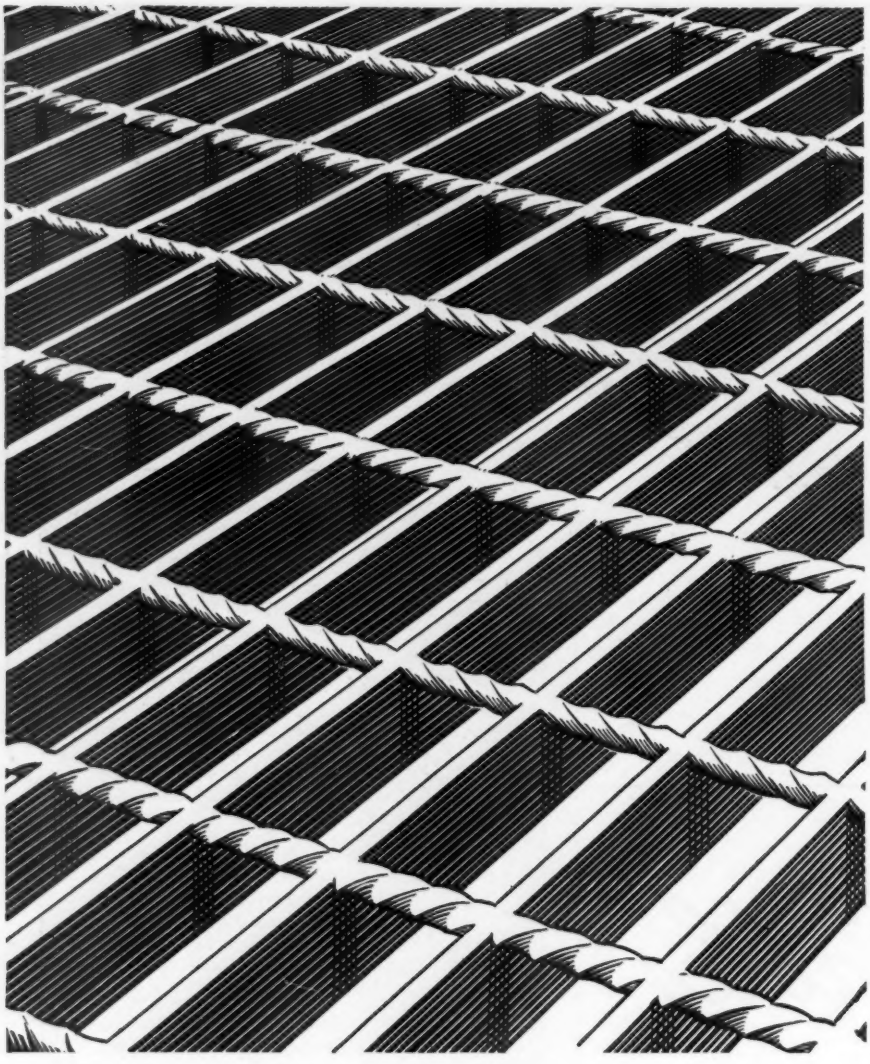
BUS CONDUCTORS

THE AMERICAN BRASS COMPANY

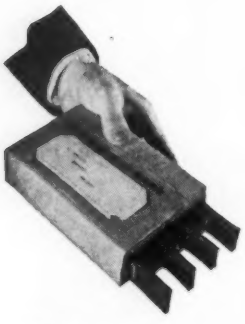
General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.



SEE THOSE TWISTED CROSS-BARS?



They're electroforged directly *into* the bearing bars to form a rigid one-piece steel "material" of guaranteed strength—with safe footing at all times . . . Blaw-Knox Grating also—

★ *Provides Maximum Open Area* for light and ventilation

★ *Is Easy to Maintain* . . . easy to paint thoroughly

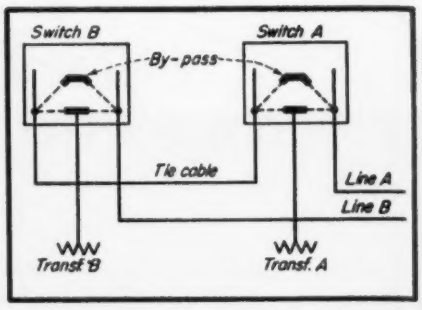
★ *Is Self-Cleaning*—no sharp angles to retain debris

★ *Economical to Install* in any size or shape

FREE...
So that you can have a "close-up" of Blaw-Knox Grating construction, write today for this "paper-weight-size sample" on your business letterhead.

BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
FARMERS BANK BLDG., PITTSBURGH 22, PA.

BLAW-KNOX ELECTROFORGED STEEL **GRATING**



CONNECTIONS OF OIL disconnecting switches to insure greatest service continuity in supplying 1,500-kva building load

tie cable switches open. In case of loss of line "B" it can be opened on switch "B", leaving line "A" on bank "A", then the tie cable on switch "A" to transformer "A" is closed, and switch "B" to transformer "B" is closed. This energizes both banks from line "A" and isolates line "B". Other switching combinations are obvious.

Although these are hand-operated disconnecting switches immersed in oil, they can be opened under load with currents up to 400 amp. As a safety precaution they are provided with a viewing window (not shown) so that position of the contacts is clearly evident.

This utility is contemplating using similar switches on feeder cables so that sections of cables or taps can be taken out of service for work on any transformer bank or on the network.

•

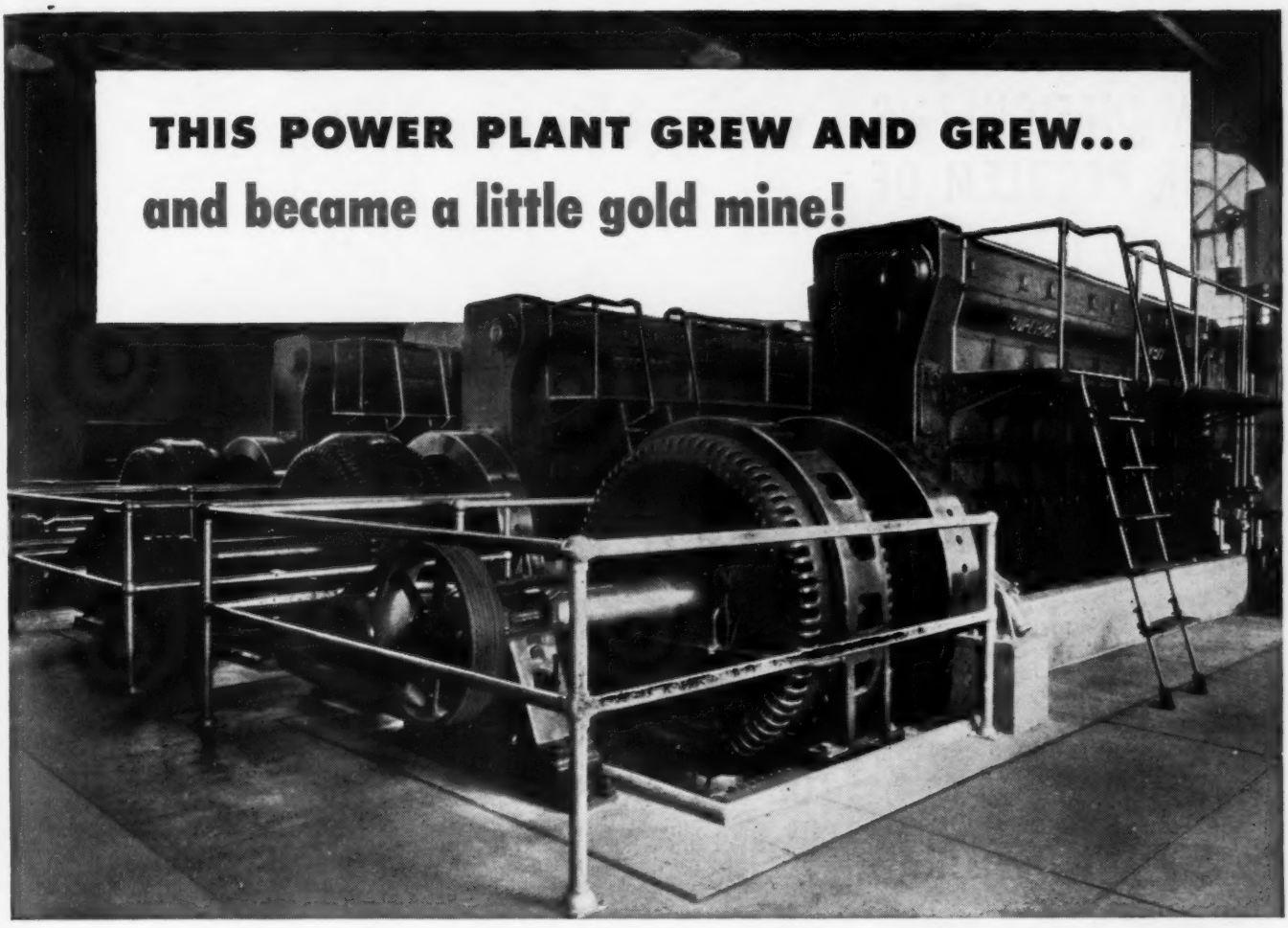
Cold-Collar Test Of High-Voltage Bushing

FOR CHECKING THE condition of high voltage insulation, the cold-collar test is included by the West Penn Power Co, Pittsburgh, Pa. This test for the top of the bushing is in addition to the power factor and energy loss method commonly known as Doble testing.

In Doble testing, the test lead is first connected to the upper end of the bushing stud. The insulation tested is the total between the center stud and the grounded flange of the bushing.

If an additional ground is placed below the top petticoat (porcelain), the portion of the insulation under the top cap is subjected to additional voltage stress. The test measures the power loss in the insulation between

THIS POWER PLANT GREW AND GREW...
and became a little gold mine!



In 1939 an Arkansas town plunged itself into a $240,000 debt to build a central power plant equipped with three, 8 cylinder 620 hp. Superior Diesels.

This plant proved to be a gold mine.

The demand for electrical power increased so rapidly that during the first five years the plant paid off the debt—provided free street lighting—cut consumer rates—and created a cash reserve! As a result of this performance, two additional 1200 hp. Superior Diesel Engines have been added to increase the plant's capacity.

Hundreds of other communities throughout the country are benefiting by the dependability and economy provided by Superior Diesels. These big, husky engines are used for water supply systems, sewage disposal plants, airport lighting and for many other vital services.

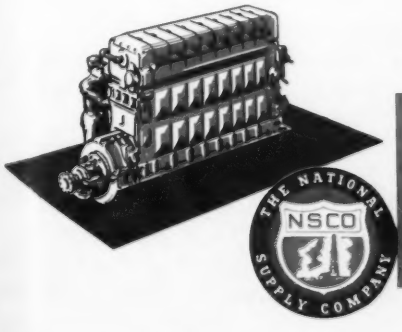
Superior Diesels are made in supercharged and non-supercharged models that range from 170 to 1500 horsepower. One of our field engineers will be glad to point out the advantages these engines have for your community.

PUSH-BUTTON DUAL FUEL

A Superior Feature

JUST PRESS A BUTTON TO BURN YOUR CHOICE OF FUEL

Superior is the first and only Diesel with push-button control of fuel selection that permits you to switch from oil to gas; or gas to oil instantly—with the flick of a finger.



SUPERIOR ENGINE DIVISION OF
THE NATIONAL SUPPLY COMPANY
Plant and General Sales Office: Springfield, Ohio

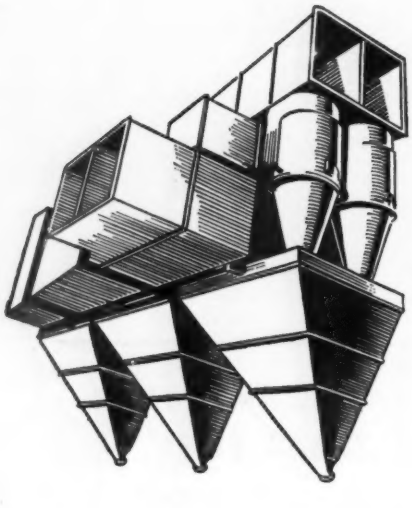
Superior DIESEL

Only Superior Diesel Engines Give You Superior Features

HOW DIFFICULT IS
YOUR PROBLEM OF

Fly-ash

COLLECTION?



You call a doctor

when you're sick—why not call upon engineering specialists to determine—and *solve*—your dust-collection problem? In the past 10 years, the Buell Engineering Company has designed and installed thousands of dust-collection systems, each planned to solve an individual problem. Each situation was different, because a broad range of industrial uses was covered. The engineering know-how behind Buell design successfully meets difficult conditions imposed by size and shape of available space, unusual dust compositions, and widely varied gas volumes. Furthermore, the Buell van Tongeren design eliminates plugging. It's all in the new 32-page catalog—write: Buell Engineering Co., 70 Pine Street, Suite 4900, New York 5, N. Y.

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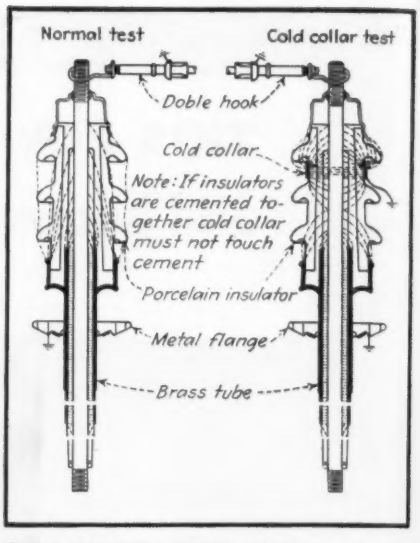
Engineered Efficiency in DUST COLLECTION



COLD-COLLAR TEST (right) and normal test for high voltage bushing. Dash lines indicate electrostatic field.

the top of the bushing and the grounded collar (below top petticoat) as well as the rest of bushing. Refer to illustration.

The difference in watts between these two readings is the loss in the top of the bushing.

Since most of the moisture enters the top of the bushing and many failures are at this point, this is a most important test. It is known as the "cold-collar" test. The cold-collar is grounded by connecting to the ring nearest the rubber on the Doble test cable or to the breaker frame. This ring is solidly grounded. (The cold-collar test is in contrast to the hot-collar test in which the collar is energized and the center conductor of the bushing is grounded).

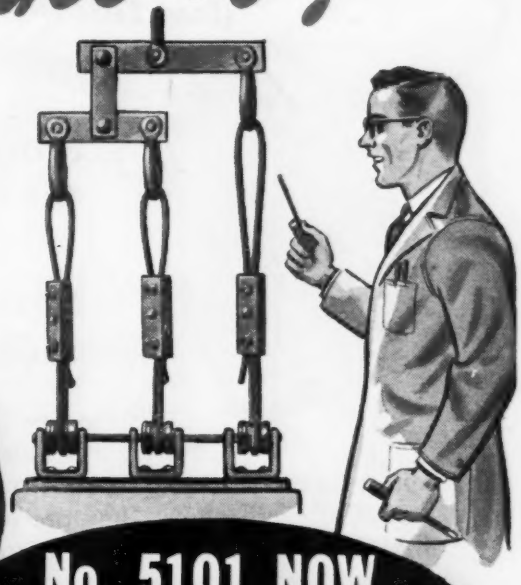
•

Versatile Pipe Bender Made From Scrap

THIS VERSATILE hydraulic pipe bender will produce even bends of any radius in pipe from ¼ to 3 in. diam. Designed and built by L. G. Woodburn of the Benson Springs plant of Florida Power Corp, the materials used were mostly scrap. Actual material purchases for such things as springs, valve, leather cups and plugs were held to about $2.

Casing of the hand-powered hydraulic jack is a piece of boiler tubing. The shaft casing is made from high-pressure steel pipe. The plunger of the jack is part of a car axle and the jack bottom is a section of hydrau-

Spools that can really take it!



No. 5101 NOW AVAILABLE FOR PROMPT DELIVERY

SECONDARY RACKS Available promptly, 120 Series, 420 Series Heavy Duty, 520 Series Medium Duty. Extra sturdy—hot dip galvanized—highest porcelain spools.

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Now you can get those tough, durable PORCELAIN PRODUCTS wet process spools —promptly. Made in accordance with standard NEMA design specifications, highest quality, wet process porcelain, chocolate brown glaze and incorporating the original Porcelain Product's design feature of double-tapered hole which practically doubles the mechanical strength and protects the spool from breakage when the rack bolt is deflected under strain.

Use them in racks, clevises, etc., wherever top performance and dependability are a "must" on your distribution system.

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Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

2 NEW SHALLCROSS LOW-RESISTANCE TEST SETS

(Bond Testers)

Linear Micro-Ohmmeter Models

These new Shallcross instruments permit quick, accurate comparison tests of extremely low resistances between 2 and 800,000 micro-ohms. They are ideally suited for testing electrical bonds, heavy current switch and relay contacts, resistivity of heavy conductors or for making low resistance measurements. Both instruments utilize the 4-terminal method of measurement, thereby minimizing lead and contact resistance.

Type 670-C, a six-range instrument (1,000 to 500,000 micro-ohms) is designed for outdoor or production line work where extreme portability is needed. It weighs only 10 lbs., operates from dry cells. Housed in steel case fitted with carrying strap.

Type No. 668 has eight ranges (200 to 800,000 micro-ohms), weighs 30 lbs. and operates from 115v 60-cycle current. It is the perfect instrument for all research, laboratory or production low-resistance tests.

WRITE FOR BULLETIN LRT-1

describing the complete line of Shallcross Low-Resistance Test Sets.

SHALLCROSS MFG. CO., Dept. EW-48 Collingdale, Pa.

SHALLCROSS

Write for Bulletins on any of these products:

- Accurate Heavy-Duty Power Resistors
- Attenuation Pads
- Attenuators — Fixed and Variable
- Ayrton Universal Shunts
- Bridges, Resistors, Decades, etc.
- DC Instrument Power Supply
- Decibel Meters
- Fault Location Bridges
- FM and Television Sound Components
- H. V. Corona-Protected Resistors
- Kelvin-Wheatstone Bridges
- Kilovoltmeters and K. V. Multipliers
- Logarithmic Decade Boxes
- Low Resistance Test Sets
- Megohm Bridges
- Percent Limit Bridges
- Portable Galvanometers
- Potentiometers — step and slide-wire
- Precision Wire-wound Resistors
- Ratio Arm Boxes
- Rotary Selector Switches
- Standards—Resistance and Decade Boxes
- Telephone Transmission Test Equipment
- Unmounted Resistance Decades
- Voltage Dividers
- Wheatstone Bridges
- Wire-wound Surge Resistors

HYDRAULIC PIPE BENDER, made from scrap material, produces complicated bends in pipe from ¼ to 3 in. in diameter. Dies shown above provide wide range of bend radius.

lic turbine shaft. Jack wings were cut from scrap boiler plates.

Two leather cups are used on the pump plunger and two on the jack plunger which is $\frac{1}{16}$ in. smaller above the leather cups. There is an oil vent at the top through the shaft casing. This extends into the oil casing so that oil escaping the plunger caps can be drained, instead of leaking out around the packing.

The pipe bender is mounted on a wheeled dolly for easy mobility in the shop. This feature adds greatly to the usefulness of the implement.

•

Assure Return Path For Thawing Currents

WATER, ELECTRICITY and gas mix better than oil and water according to experts on the gas staff of Monongahela Power Company. At least that is their explanation of the loss of gas service by a group of customers. Gas in the mains was found to have been replaced by water.

Excavation disclosed the fact that a hole in a 60 psi 1-in. water main was directly adjacent a corresponding hole in the gas pipe and this accounted for the water in the latter. An 8-in. gas pressure is no match for 60 psi. The two holes were found to have been caused by an arc which bridged the space between the two pipes when heavy thawing current was applied to unfreeze the water service pipe. The moral was considered to be the provision of an electrically continuous circuit for the thawing operation.

SAVE TIME on Construction Jobs

Specify CHANCE Tools

and get these extra features:

1. Installing bar, tamp and anchor retriever combined in one tool.

2. Safe, reversible point pike pole with reinforced butt — wire lift attachment.

3. Maul with seasoned hickory inserts to prevent damage when driving anchor rods.

4. Trip auger—bores like a bit, telescoping rod from 5 to 8 feet, adjustable reamer for various hole sizes, easy dump trip.

5. Anchor expanding and tamping bar. Hooks around rod to prevent slipping off anchor top plate.

6. Transformer gin with new light weight aluminum fitted chain tightener. Easy to apply. Has safety lock.

7. Tugger pulls or lifts in any position. Link type chain prevents binding or kinking. Light weight diecast aluminum alloy handle, housing and cover.

Write for Complete Information Today

abc INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MO. • SAN FRANCISCO, CALIF.

LOAD BUILDING

Farm Service Makes Strides In Virginia

L. L. KOONTZ
Appalachian Electric Power Co
Roanoke, Va

RURAL ELECTRIFICATION progress in Virginia has been steady and effective since its beginning over twenty-five years ago. Rural line extension programs of practically all the electric service organizations operating in Virginia were stopped by the war. These programs have been resumed and expanded in scope. Rural extension plans and policies, along with rates, have been simplified and liberalized over the years to a point where an outstanding rural electrification job, based on rather complete area coverage, is readily in sight for the entire state. The figures tell the story in the table that is shown above.

Period Ending	Miles of Rural Line in Operation	Farms Connected	Total Farm and Rural Customers
Dec. 31, 1924.....	300	300	1,500
Dec. 31, 1935.....	6,099	16,000	40,419
Dec. 31, 1941.....	18,789	45,000	104,703
Dec. 31, 1946.....	25,611	82,000	138,178
Dec. 31, 1949.....	38,000	150,000	205,000

At the close of 1947 about 65% of Virginia farms, with occupied dwellings, were connected for electric service. It is anticipated, based on the continuation of the present aggressive rural line building programs of the power companies, that by the end of 1949 approximately 90% will be served.

By the end of 1949 the electric service organizations operating in Virginia will have an investment in distribution facilities serving rural and farm areas of approximately 100 million dollars. It has been estimated that the farm and rural customers will have another 100 million dollars invested in electric wiring and equipment.

• • •

Chickenhouse Litter-Stirrer Saves Work

MOTOR-DRIVEN "homogenizer" or litter-stirrer is newest labor-saving electric tool which fulfills a long-felt desire of poultrymen

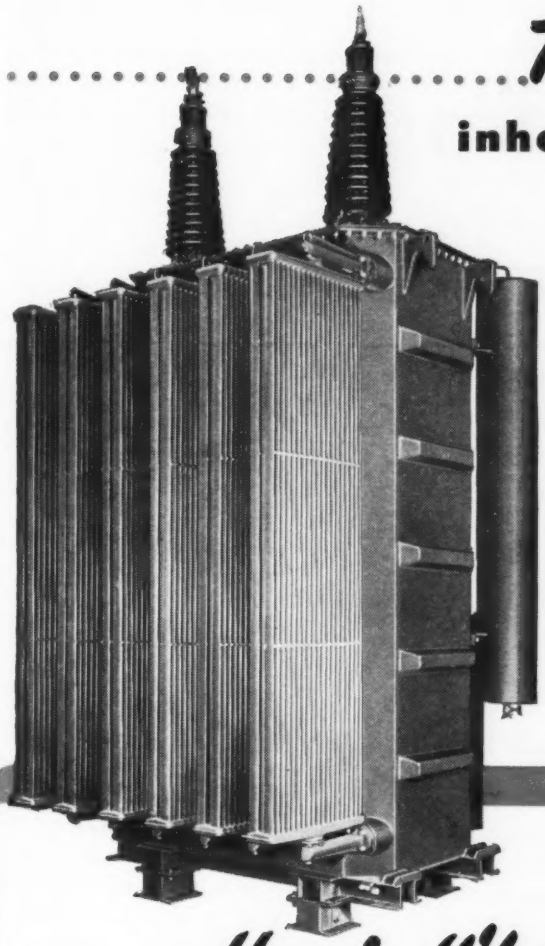
DEVELOPED IN THE agricultural experiment station of Puget Sound Power & Light Co, the chickenhouse litter-stirrer illustrated fills a long-felt desire of the poultry farmer. The need was for a piece of power-driven equipment to replace a fork and hand labor in stirring or fluffing-up the litter on the floor of chicken houses. Current practice in poultry raising is to use a litter 8 in. deep made up of straw or peat moss. Such litters are used up to a year. They pack down and must be stirred frequently.

Fork Agitators

Considerable experimental and development work resulted in a stirrer consisting of two 3-pronged fork agitators with axis of rotation vertical, mounted on a rubber-tired cultivator-type chassis. The agitators are driven at about 80 rpm through V-belts and an automobile steering gear worm drive by a double-ended ½-hp motor.

In a large poultry operation, stir-

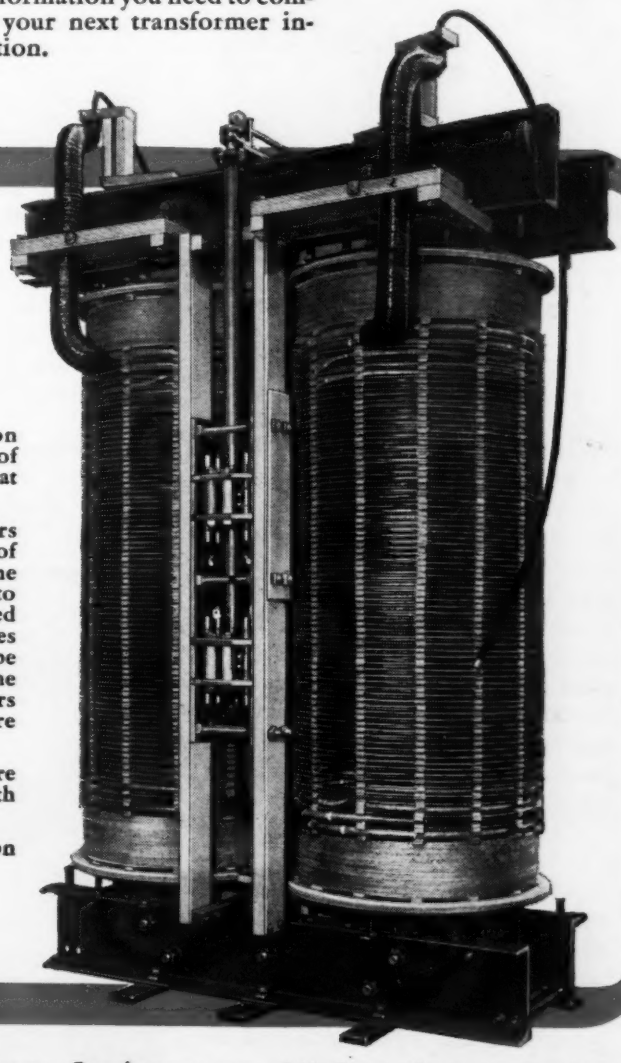
The HIGH QUALITY inherent in Wagner Transformers assures Unfailing Service



Wagner Power Transformers are transformers with a reputation for Quality—established through more than fifty years of service to the power industry. During this time Wagner has consistently maintained a policy of always utilizing the latest developments in transformer design, materials, and processes of manufacture. As a result of this policy, Wagner Transformers have always given efficient, dependable service with minimum maintenance.

Wagner maintains twenty-nine branch offices, located in principal cities, for quick, convenient service and advice. These offices are manned by trained field engineers who will gladly give you the information you need to complete your next transformer installation.

...Here's Why!



Meticulous attention to even the smallest details of construction are responsible for the long life and dependable operation of Wagner transformers. Some of these details are pictured at the right.

All coils are separated from each other by pressboard washers and generous oil ducts. Buffer coils at the top or line-end of the stacks are heavily insulated to absorb the impact of line disturbances. A large number of radial spacers are used to produce substantial coil assemblies which are securely clamped between steel rings, reinforced by the structural steel end plates and designed to withstand the distorting forces which may be caused by short-circuits on the line or distribution system. The out-going leads are covered with more than a hundred layers of varnished muslin to insulate them from the tank and core structural parts.

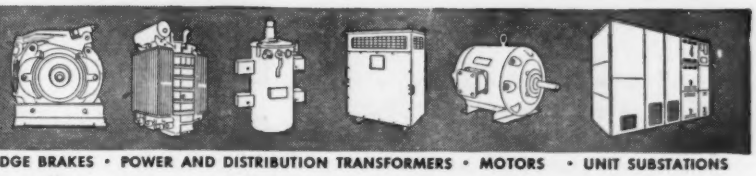
The snap-action tap changers are rigidly mounted and are operated from outside the tank. A weather-proof cap with provision for padlocking protects the adjustable head.

The complete story of Wagner Power Transformer construction is told in Bulletin TU-181. Write for your copy today.

Wagner Electric Corporation
6456 PLYMOUTH AVENUE, ST. LOUIS 14, MO.

Wagner Electric Corporation EST. 1891

Consult Wagner Engineers on All Transformer Problems



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

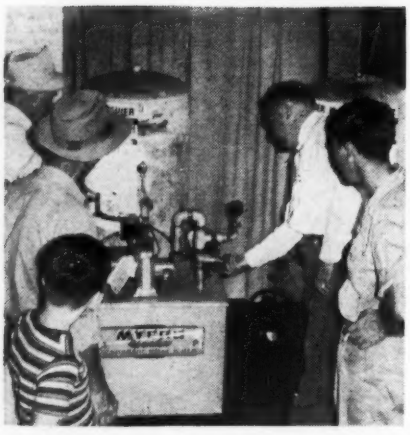
ELECTRICAL AND AUTOMOTIVE PRODUCTS

T48-5

ring or conditioning a litter is a work of hours with the new tool instead of days by hand. Trial field use has proved the device's practicability and worth, but it is not yet on the market. Development work was under the direction of Arthur Kramer, head of the utility's agricultural experiment station.

• • •

Small Fairs Bring Rural Service Results



AUTOMATIC water system attracts the pail carriers

W. C. BUCHANAN
Agricultural Engineer, Pulaski District
Appalachian Electric Power Co
Marion, Va.

OF 1,500 WHO attended, 746 farmers and farmers' wives checked equipment and appliances they wanted, making a total of 1,671 prospective sales resulting from two fairs in Virginia last year. These were not state, nor even county, fairs. They were just community exhibitions put on at local high schools. Experience in these instances has convinced the rural department of the Appalachian Electric Power Co that for concrete results the small community fair is as good a producer of sales as the larger exhibitions, perhaps even better.

Locally Organized

In each case, most of the exhibit was provided by local dealers, who were eager to participate. They brought in and set up the equipment and appliances they had for sale. The power company organized the exhibit and furnished an agricultural engineer and a home economist to give demonstrations and answer questions.

All persons looking over the exhibits were asked to register for prizes and to check on the registry cards the electrical equipment and appliances they wanted and in addition, the ones they already had.

Big prize was an electric brooder, built by the power company rural department, which was offered together with 50 baby chicks and 50 pounds of feed, locally contributed. This was the only prize at the first fair. At the second, 5 others—waffle iron, coffee maker, hot plate, and 2 irons—were offered by dealers. This difference in prizes perhaps explains the larger number of sales prospects from the Sugar Grove fair as shown in the accompanying tabulation.

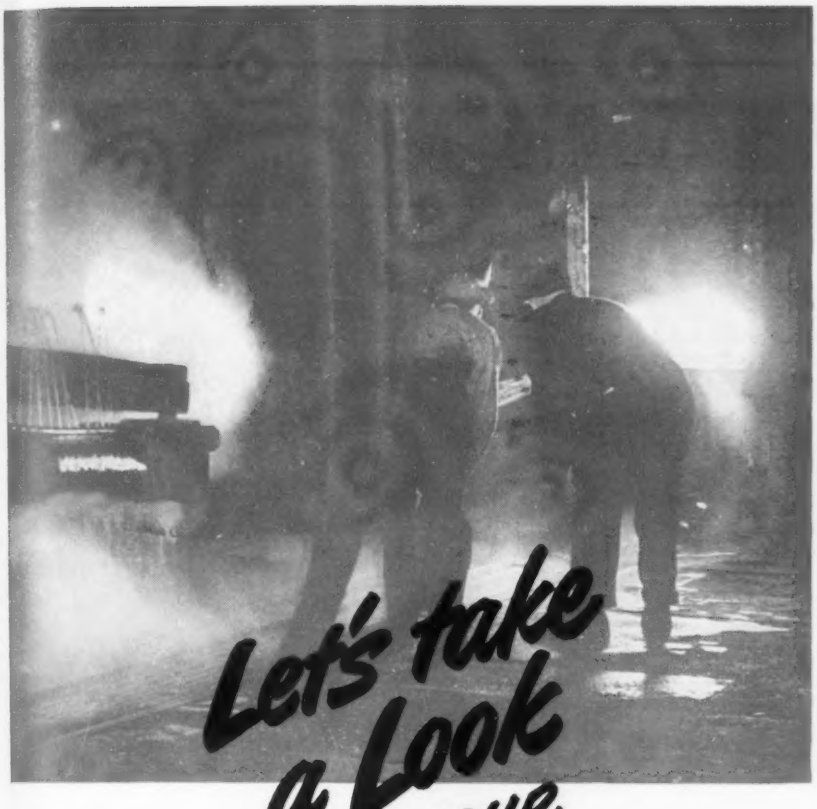
Record of Community Fair Results

	Rich Valley Fair	Sugar Grove Fair	Totals
Estimated Attendance	700	800	1,500
Registered in Electrical Exhibit	411	644	1,055
Checked Equipment and Appliances Wanted	248	498	746
Sales Prospects—Totals	479	1,192	1,671
Range	92	218	310
Water System	23	38	61
Refrigerator	72	226	298
Water Heater	40	75	115
Washing Machine	44	173	217
Brooder	23	48	71
Feed Grinder	17	35	52
Hay Dryer	11	23	34
Farm Motor	11	40	51
Milking Machine	20	40	60
Milk Cooler	16	25	41
Home Freezer	58	105	163
Iron	15	67	82
Radio	37	79	116

Cold Cathode Makes Impressive Design

Cutler Light Manufacturing Co

IN THIS 8-TUBE rectangle of cold cathode in the first Philadelphia store of the Ripley chain of men's wear shops, are about 3,000 ft of tubing. The tubes are set flush in the ceiling. In the center panel are 24 down lights adding interest to the ceiling pattern as well as lighting to best advantage goods displayed in the racks below



HEAT PROBLEMS

Take a minute to think back over your big power cable repair jobs. How many of them were necessary because wiring couldn't stand the struggle with ambient heat — because power cables were no match for the temperatures they had to meet?

For those problem jobs — for those jobs where heat is a constant threat — look into the dollar-saving, timesaving advantages of Deltabeston* power cables. They're real heat beaters, built to cut maintenance costs around hot installations like furnaces, soaking pits, and hot strip mills. For boiler rooms and other applications where a combination of heat and moisture must be beaten, there are special Deltabeston types to do the job.

Whatever your heat problem may be, there's a Deltabeston power cable that will solve it. Insulated with felted asbestos and sheathed in asbestos braid or lead, Deltabeston power cables are made to fight heat and operating abuse.

Your General Electric merchandise distributor is always ready to give you help in matching Deltabeston power cables to your specific requirements — or, if your problem is unusual, to put you in touch with a field specialist on heat-beating wires and cables. For further information, write to Section Y97-427, General Electric Company, Bridgeport 2, Connecticut.

*Trade-mark Reg. U. S. Pat. Off.

HI-AMBIENTS

Application Hints from Your Deltabeston Distributor

When the thermometer blows its top, something's sure to happen to wiring if it's not selected to beat the heat. For extra-high heats, General Electric offers a line of silicone-treated cables that stay on the job at temperatures as high as 200 C (392 F). These silicone-treated Deltabeston cables were developed for infrared oven use, and are now available to help you beat the heat in 300- and 600-volt service.

To make your job of selecting heat-beating wires and cords easier, General Electric has prepared a new catalog covering Deltabeston wires and cords for stoves, ranges, appliances, and fixtures. For your free copy, write to Section Y97-1127, General Electric Company, Bridgeport 2, Connecticut, and ask for the *Deltabeston Wires and Cords Catalog.*

Feverish motors can be troublesome when they're not prepared to take high temperatures. But you can prepare them for high-temperature operation with Deltabeston asbestos- or glass-insulated magnet wire. Even the most intricate coils can be formed with Deltabeston, because it's made of flexible, soft copper. It's available in round, square, and rectangular shapes, in sizes to fit all needs. If you do your own motor winding, use Deltabeston magnet wire. If you send your jobs to an outside shop, be sure to specify it.

For assistance on any wiring application where heat is a factor, contact your General Electric merchandise distributor. He'll gladly help you choose the right materials for your job.

DELTABESTON
Power Cable
Built to beat the heat

GENERAL ELECTRIC

NEW EQUIPMENT

Safety Seat

A NEW INDUSTRIAL safety seat with shoulder harness has been developed so that erectors, painters, repairman, maintenance men, tree trimmers and surgeons, and other skilled workmen while

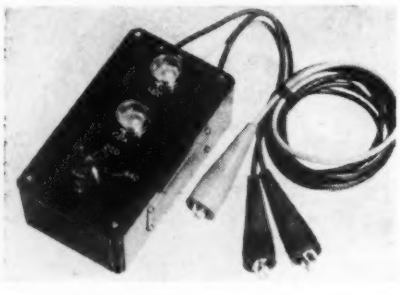
suspended in air can work with new confidence. Also it is reported to hold a helpless person upright in the saddle during rescue work. The seat is produced by Buckingham Mfg Co, Inc, Binghamton, N. Y.

The equipment includes a solid wooden seat 15 in. long and 5¾ in. wide, belt made of 4-ply cotton webbing and fitted with a ring and snap fastener for tools, chest harness attached to a clamp well up on the supporting rope, forged steel safety hook, and drop forged D-rings.

•

Phase Indicator

A POCKET-SIZE, lightweight phase sequence indicator has been developed by Associated Research, Inc, 231 Green St, Chicago 7, Ill. It can be used for installing and servicing polyphase wattmeters, motors, watthour meters, power factor meters, alternators, transformer banks and other equipment.



The three 3-ft colored leads are connected, and switch turned to proper voltage. If rotation is CBA, lower light will glow; if ABC, top light will glow. The lights are Y-connected in the circuit. The model 40 instrument measures 2 x 3 x 5½ in. and can be used with 115, 200, and 440-v circuits.

•

Armor Rods

PREFORMED ARMOR rods for conductors are wires of spring steel, aluminum or copper, being produced by the newly formed Preformed Line Products Co, Bulkley Bldg, Cleveland, Ohio. The rods are formed in open helicies with a uniform pitch of 8 to 12 times the diameter of the conductor upon which they are to be applied.

In application to deenergized conductors, the manufacturer explains, about one-half the necessary armor rods are laid across the conductor, and rotated around it with a wiping action of the hands. Then the remaining rods are applied in the same manner. At the completion of this process, the rods snap into place, and form a tight-fitting, protective cover. The rods can be applied also to energized lines.

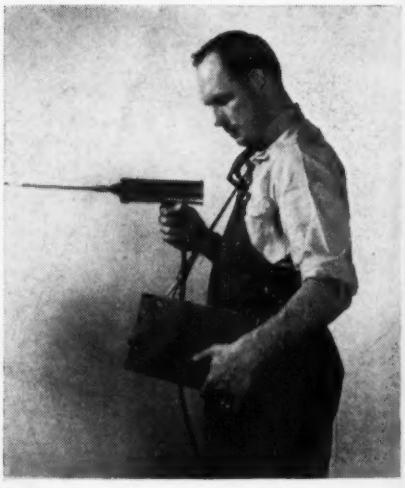
•

Leak Detector

A PORTABLE LEAK detector, announced by the Special Products Division of the General Electric Co, is applicable for tanks, boilers, piping, and other closed systems into which halogen compounds can be introduced as a tracer. An ordinary joint or seam can be tested in the field as well as on the assembly line. The detector unit weighs only 3 lb and the control unit 15 lb.

A hand-held probe contains a sensitive element which is responsive to halogens in the air, and has an 8-ft cable for connection to the control unit.

The portable control unit contains the power supply, amplifier, indicating instrument, and necessary controls. A 25-ft lead is supplied for connecting the



control unit to 115-v, 60-cycle power supply.

Nozzle of the probe is held about one-half inch from the surface of the unit being tested, and is moved about at the rate of about one-half inch per second. When halogen vapor is drawn in, an increase in current is indicated on the milliammeter. Provision is made on the control unit for using earphones or a loudspeaker to indicate leaks.

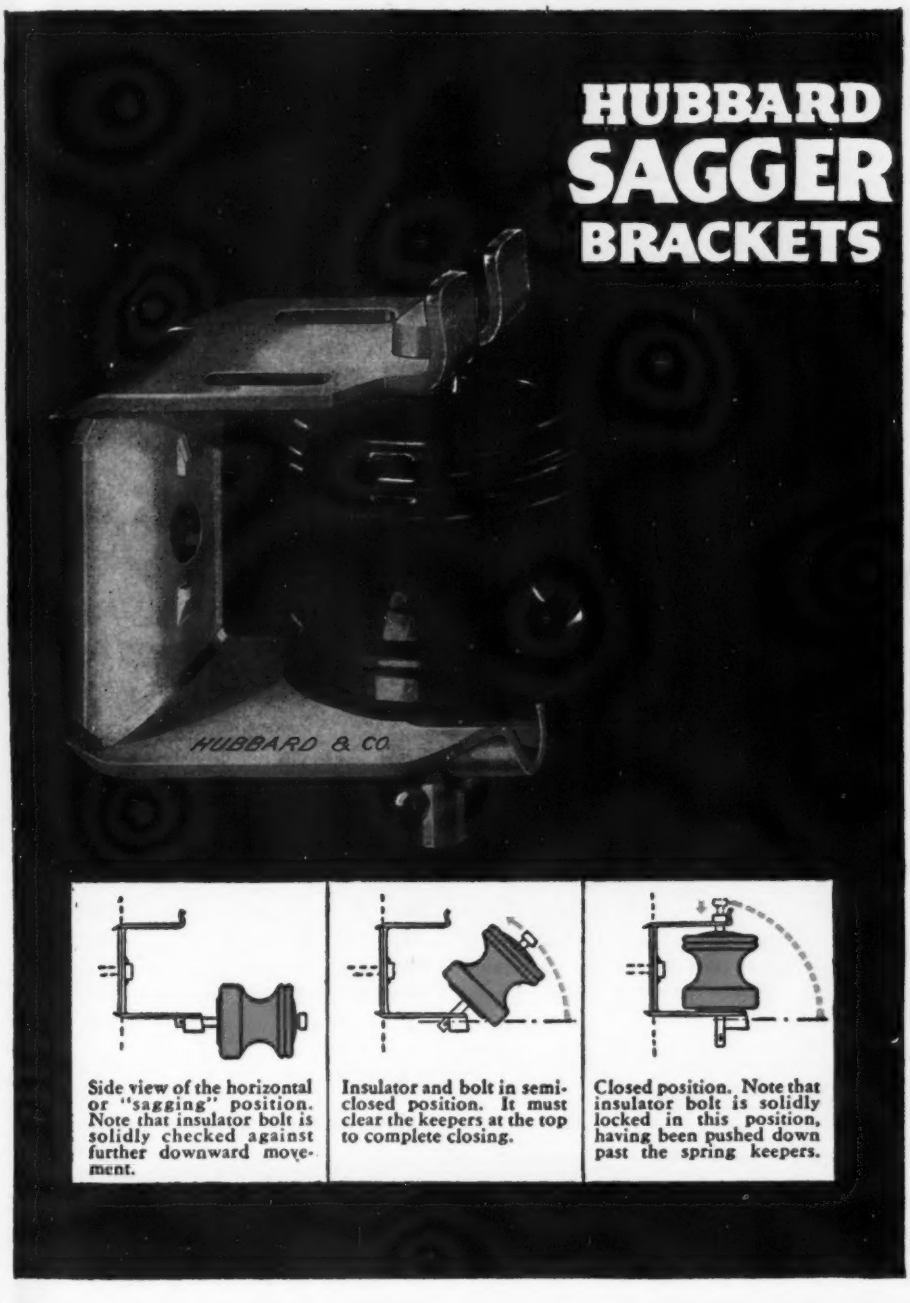
•

Midget Relay

A SMALL RELAY, Tiny Mite, type 000 with a volume of only 0.35 cu in. has been announced by Advance Electric & Relay Co, Los Angeles, Calif. Laminated phenolic is used to insulate the contacts from ground.

Average power requirement is from 0.35 to 0.50 w but can be made less. The relay can be supplied with any coil resistance from 1 to 2000 ohms

Something NEW IN SECONDARY DISTRIBUTION

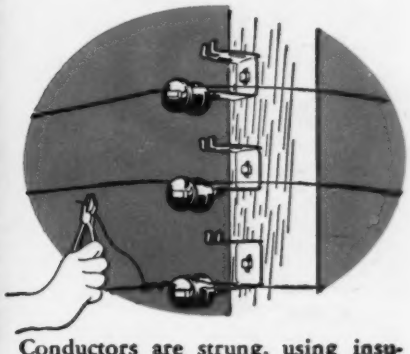


Side view of the horizontal or "sagging" position. Note that insulator bolt is solidly checked against further downward movement.

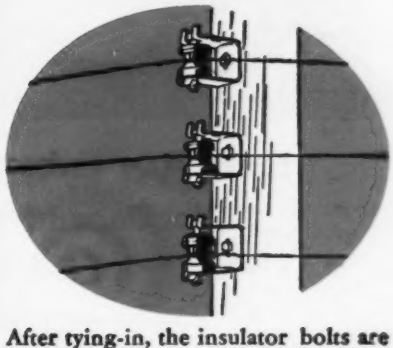
Insulator and bolt in semi-closed position. It must clear the keepers at the top to complete closing.

Closed position. Note that insulator bolt is solidly locked in this position, having been pushed down past the spring keepers.

Holes are drilled at correct spacing and machine bolt is inserted as shown.



Conductors are strung, using insulators as pulleys, until desired sag is obtained after which they are tied-in while still in the horizontal position.



After tying-in, the insulator bolts are raised to the vertical and dropped into the lock position.

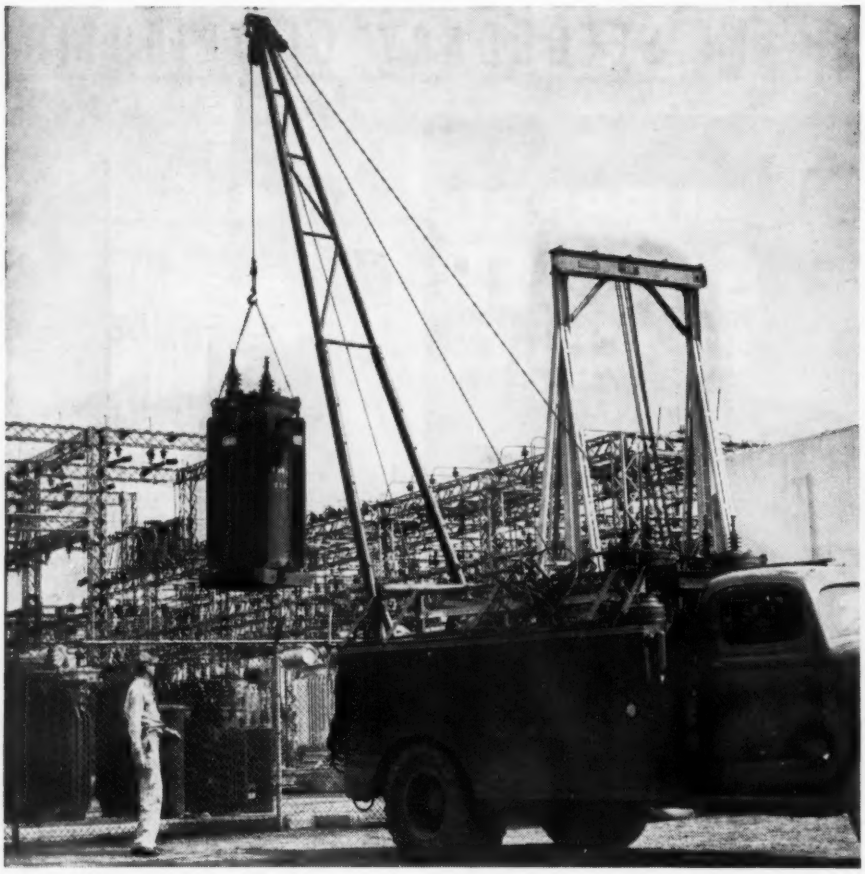
For secondary distribution circuits, where a variety of problems are to be met, Hubbard No. 710 Sagger Bracket is the most flexible choice to meet the requirements. This Bracket may be described as a single, *separate,* secondary-rack point, which may be used with one or more similar points, at any desired spacing for any number of conductors.

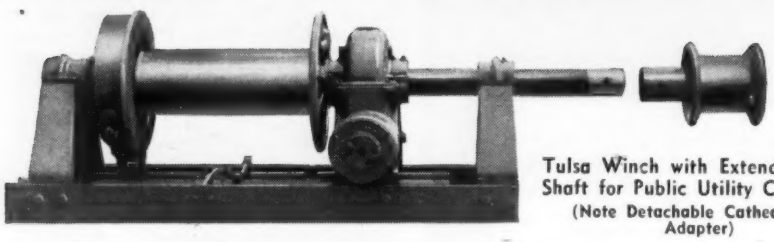
No. 710 Brackets are versatile in other ways also. The patented feature is the arrangement of the insulator bolt which may be dropped to a horizontal position to allow the "sagging" of conductors with the insulator spool acting as a pulley. Insulator Bolts are locked in position when closed or open. Strength against line pull is provided by the broad back bearing against the pole, the backs being 3-inches in width. Spurs at the corners prevent the bracket from turning during and after installation. Bolt heads are trapped in the back to prevent turning while tightening.

Hubbard Sagger Brackets have been tested and proved in service. Highly adaptable to any conditions, they have drawn praise from engineers, in every instance of the many installations made to date.

HUBBARD AND COMPANY

PITTSBURGH · CHICAGO **OAKLAND · CALIFORNIA**





Tulsa Winch with Extended Drum Shaft for Public Utility Companies
(Note Detachable Cathead and Adapter)

UTILITY MAN REPORTS:

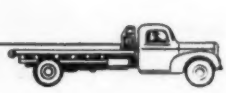
"We Depend on Tulsa Winches *FOR SAFETY!"*

A public utility user of Tulsa Winches reports: "In our kind of business our lives often depend on safety. When we're winching a transformer, or some object that is dangerous, close to high-tension lines, we have to have a winch that will hold the load. The slighest slip could result in serious trouble. Our men often have to work DIRECTLY UNDER the load too. We think Tulsa Winches are safe, because we know they hold the load!"

A complete line of winches for all trucks, ½-ton to 8-ton and larger.

Write for Literature and further information. Dept. E 122.

Tulsa Winch
TULSA, OKLAHOMA DIVISION OF VICKERS Inc.

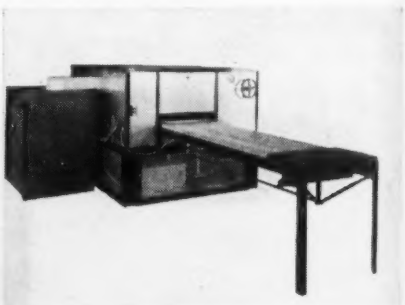


and for any voltage from 1 to 50 d-c. The spdt contacts are rated 0.35 amp at 60 v d-c or 115 v a-c, resistance load.

•

Wood-Gluing Press

A FULLY AUTOMATIC, hydraulic, wood-gluing batch press offered as a packaged unit together with a generator for dielectric heating has been announced by the Weldon-Flinchbaugh Co, York, Pa. The press is shielded on



all sides with 18-gage aluminum, has filter capacitors, and will suppress radiations to a strength of less than 10 microvolts per mile.

Hydraulic cylinders apply pressure to the top platen and edges. A 7½ hp, motor-driven pump and 50-gal oil reservoir are included. The doors on the in-feed and out-feed are opened and closed automatically. With a 10-kw, 5-Mc Westinghouse generator and staggered electrodes, the press will handle 2,500 sq in of glue per min of soft woods or 1,000 sq in per min of hardwood. Standard platens are available in sizes 26 x 26 in. to 42 x 95 in.

•

Retrieving Tool

TO RETRIEVE lost parts such as nuts, bolts, screws and washers, and to save time, the Magimmicks have been designed by Ullman Products Corp, 152 Prospect Ave, Brooklyn 15, N. Y.

The tools are the ball point type so that the magnetic section will remain at any angle. The Senior is the telescopic type ½ in. diameter and will open to 26 in. The Junior has a 5/16 in. diam and is 8⅜ in. long.

•

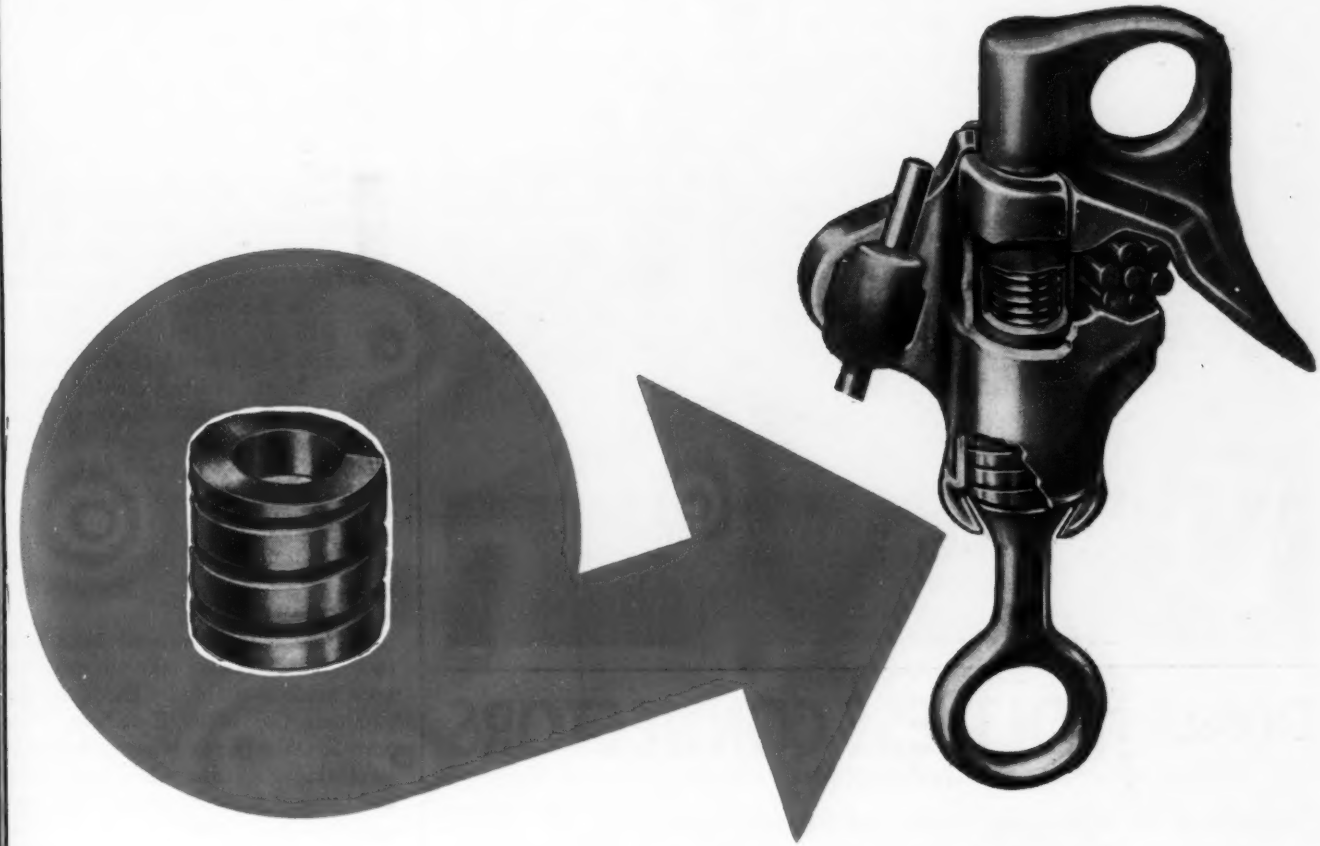
Power Supply Unit

A BENCH TYPE model 500-SV, combination a-c d-c power supply unit is illustrated. It is produced by Arthur E. Booth Co, 307 East Third St, Los Angeles 13, Calif. Operation is from a 115-v, single-phase, 50-60 cycle input.

The unit provides two independent output circuits with a vernier control included in one circuit. It is suitable

FARGO

The spring makes the difference!



CAT. NO. AGE-1	CAT. NO. AGE-2
Run Max. 250 MCM or 2 ACSR plus armor	Run Max. 750 MCM or 4/0 ACSR plus armor
Min. #6 sol. copper	Min. #4/0 str.
Tap Max. #2/0 str.	Tap Max. 250 MCM
Min. #8 str.	Min. #6 Sol.

YES—this clamp is different because the built in spring makes up for variables caused by fault currents, atmospheric changes, varying loads and our old friend—the "relaxation" or "flow" of copper.

The spring too, makes the clamp vibration proof as well as compensating for the different torque linemen use in tightening any bolt or clamp.

For aluminum connections the clamp is available in both electro-zinc plated bronze and all aluminum alloys.

DISTRIBUTED BY

LINE MATERIAL COMPANY MILWAUKEE, WISCONSIN

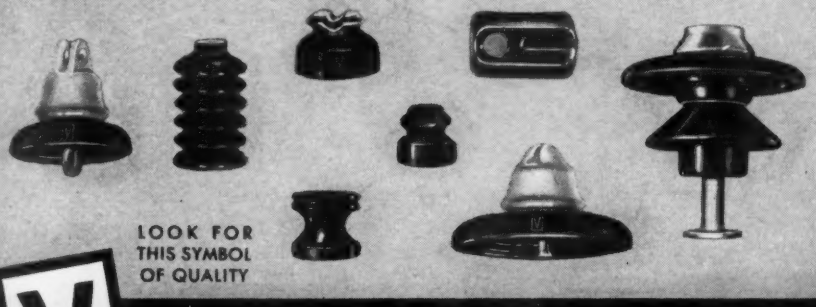
FARGO MFG. COMPANY INC.

POUGHKEEPSIE, N. Y.

ANOTHER STEP IN THE PROGRESS AND GROWTH OF VICTOR...OUR NEW, MODERN KILN NO. 3...

For DEPENDABLE Insulators Specify VICTOR

HIGH tension porcelain insulators made at Victor have passed the most *severe* tests on countless types of installations during the past 50 years. For safety, service and satisfaction, specify "Victor." We are doing our utmost to maintain dependable deliveries.



LOOK FOR THIS SYMBOL OF QUALITY

V

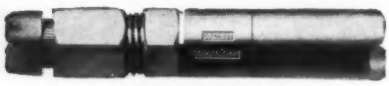
VICTOR INSULATORS, Inc., Victor, N.Y.

BIRTHPLACE OF FIRST WET PROCESS HIGH-VOLTAGE INSULATORS

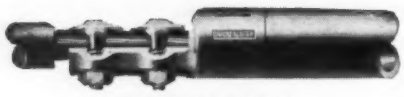
DOSSERT BOLTLESS CONNECTORS

(Patent No. 2198964)

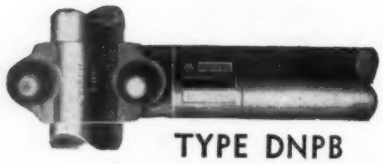
Supplied in various types of connectors embodying the no bolt connector principle



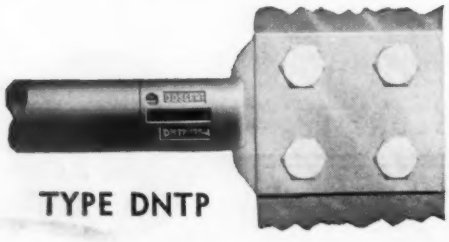
TYPE DNPC



TYPE DNCU



TYPE DNPB



TYPE DNTP

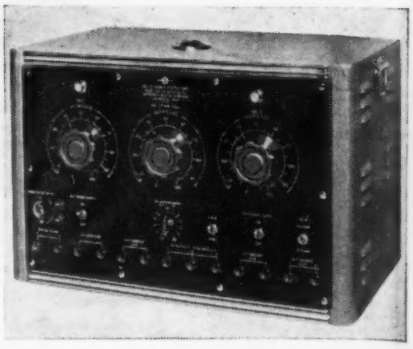
Easily and quickly installed.
High pressure, internal-expansion connectors provide permanent, vibration-proof grip on tubing.
Reduces bulkiness, and effects streamlining which facilitates taping and reflects neat appearance.
Also available in other types of fittings, such as: couplers, reducing couplers, elbows, and in various corresponding combinations of tubular bus and cable.

"Insist on a Genuine DOSSERT"

To be sure of a genuine DOSSERT make sure the name DOSSERT is on your connector.

Write for particulars to Dep't 2

DOSSERT MFG. CORP.
249-255 HURON STREET, BROOKLYN 22, N. Y.
SINCE 1904



for testing double coil instruments and relays.

Circuit No. 1 provides an a-c output of 0 to 10 amp with a maximum of 8v, or 0 to 30/75/150/300/600/750 v with a maximum of 200 ma. It also provides a d-c output of 0 to 20/50/125/250/500/750 v with a maximum of 175 ma. Ripple on d-c output is reported less than 0.25%.

Circuit No. 2 provides an a-c output of 0 to 10 amp with a maximum 10 v, or 0 to 135 v with a maximum of 3 amp. It also provides a d-c output of 0 to 10 amp with a maximum of 3 v. Ripple on d-c output is less than 5%.

•

Cord Reel

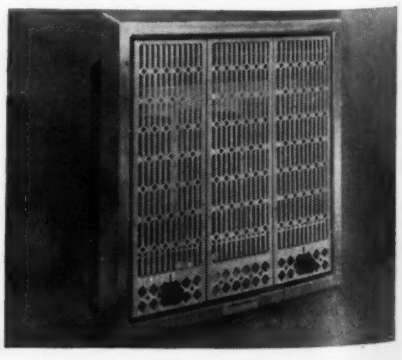
DESIGNED FOR overhead installation, two new models of take-up reels have been made available by Benjamin Reel Products Co, 10700 Broadway, Cleveland 5, Ohio. Each is equipped with a level-winder to distribute cord evenly and stack it properly when retracted.

Both models have a swivel for approximately 180 deg, a rocker bracket for approximately 90 deg, a stop on the cord to prevent full retraction, and a pigtail with male attachment plug. One model has 20 ft of SJ 18/2 r-c cord with lamp guard, reflector, and switch in rubber handle. Other model has 25 ft SV 18/2 r-c cord with female connector.

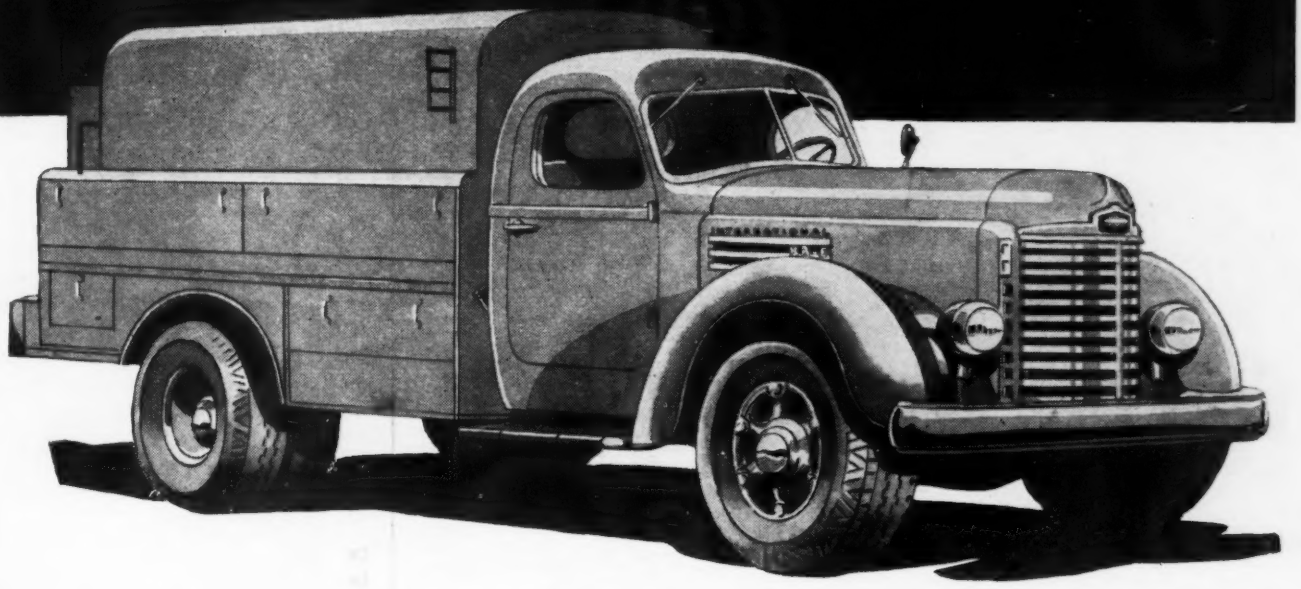
•

Wall Model Heaters

A BUILT-IN THERMOSTAT with adjustable control for maintaining a desired temperature to provide economical per-



HOW INTERNATIONAL TRUCKS ARE MASTERFULLY SPECIALIZED TO THEIR JOBS



Today's Internationals are the finest values in International Truck history. And International values are so outstanding that for each of the last 16 years more heavy-duty Internationals have been bought by American commerce and industry than any other make.

But rugged quality is only one reason for International leadership. Another is International's masterful ability to *specialize* trucks to their jobs.

There are 22 basic International models. Gross weight ratings range from 4,400 to 90,000 pounds. Thirteen different engines are used. Axles, transmissions and tandems are available for every requirement.

International specializes its 22 basic models into more than 1,000 different type trucks —a result of 41 years' experience, engineering skill and matchless facilities. *That's job fitting!*

Now add this: International can accurately tell every operator just what his maximum loads should be in terms of the exact conditions under which his trucks operate —an exclusive International service that enables the operator to get the most in operating economy, low maintenance costs, and long, trouble-free performance.

For details of today's Internationals, *expertly specialized,* see your International Dealer or Branch.

Motor Truck Division
INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago 1, Illinois

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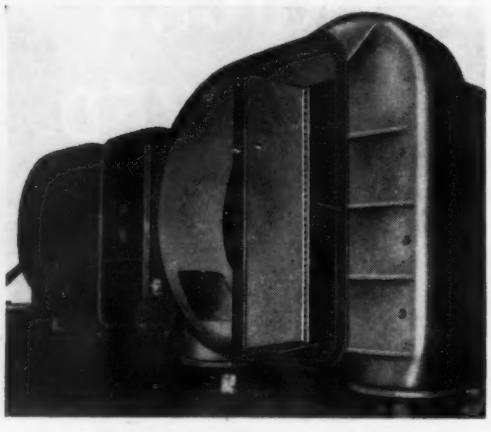
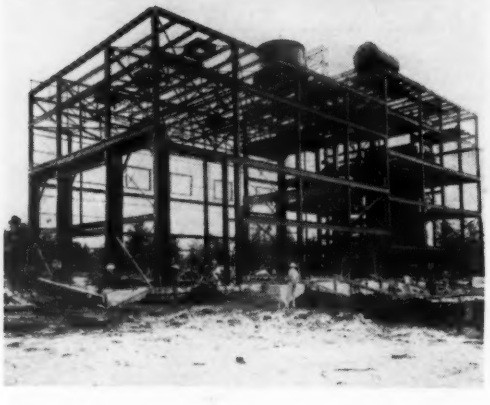
INTERNATIONAL

INTERNATIONAL Trucks

STEEL for POWER



At left, three of these giant twin-type steam condensers were fabricated by Ingalls and purchased by the Condenser Service and Engineering Co., Hoboken, N. J., for the Los Angeles Municipal Department of Water and Power. Below, Plant Eaton, largest steam power plant in Mississippi, fabricated and erected for Mississippi Power Co., Hattiesburg. Consult Ingalls for your fabricated steel needs, large or small.



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STEEL

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Executive office, Birmingham, Ala.
New York office, 1 E. 42nd St.

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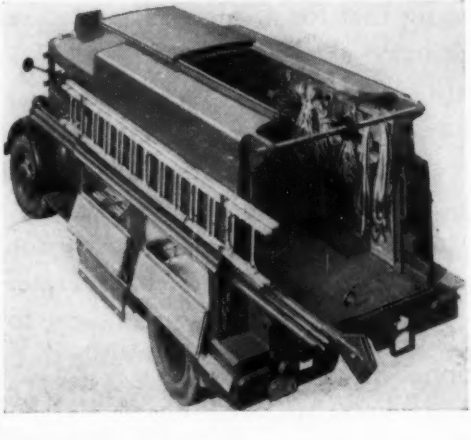

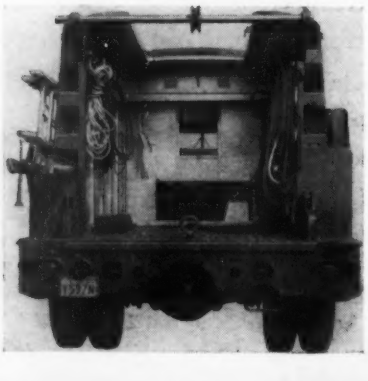

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BRINBERG BODY BUILDERS
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formance is the feature of two new models of electric heaters announced by the Electric Heating Dept, Westinghouse Electric Corp, Emeryville 8, Calif. The wall model (illustrated) is designed to be recessed in the wall to save space. The floor model is 19 in. high and is suitable for locations where added heat is needed. Both are furnished with grills.

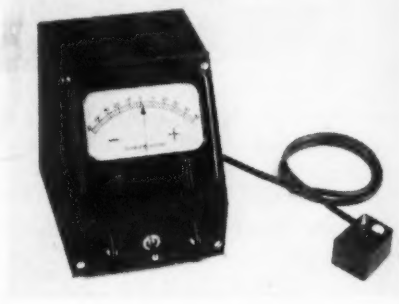
Heating is by both radiation and convection. The vertical semi-cylindrical heating element consists of nickel-chrome wire supported by a ceramic post. The units range in 1500, 2000, 3000 and 4000 w capacities and operate on 230 v a-c.

•

Electric Micrometer

FOR MEASURING, gaging and telemetering remote indications at distances up to 100 ft, such are the purposes of an electric micrometer developed by Stevens-Arnold Inc, 22 Elkins St, South Boston 27, Mass.

The device is arranged for battery operation. Transmitter is a sealed unit



with a plunger to accept motions of plus or minus 0.010 in. Mechanical motion is translated to electrical energy and sent to the control unit. The control unit has two adjustments and a zero center indicating instrument which can be read to 0.00025 in. on a 4-in. scale.

•

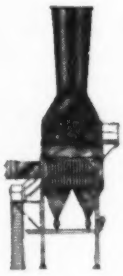
Dynamometer

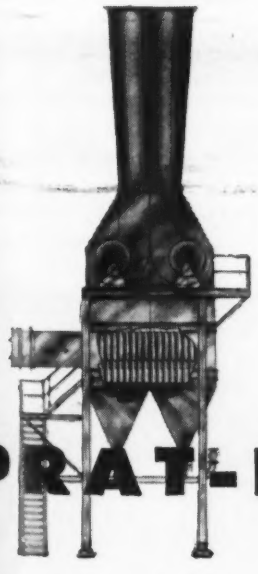
A NEW 25-HP transmission and absorption dynamometer, with a speed range of 200 to 6500 rpm, is announced by the Electro Mechanical Devices Co, 49 Selden St, Detroit 1, Mich. This unit is designed for testing electric motors, air compressors, fluid motors, fuel pumps, gear pumps, and gasoline engines.

The Model E is a self-contained unit, with the motor generator set mounted and wired in the base. One control is used for all tests; no switching is said to be necessary to go from motoring to absorption. Controls have precautions against overload, overspeed, and field

COORDINATION

Prerequisite to Induced Draft Efficiency





Coordination of the components is as important to the efficiency of Induced Draft Equipment as it is to the smooth harmony of a ballet.

Beside the disadvantage of higher cost when installed separately—unit by unit—the non-integrated breeching, I.D. Fan and Stack, in many cases, operate at sub-standard efficiency due to lack of over-all unified engineering.

Prat-Daniel research has evolved an induced draft system that eliminates this problem . . . provides the absolute ultimate in fuel efficiency.

Result—the well-known Thermix Fan Stack! Inlet Breeching, Fan and Stack combined in a single, integrated draft-producing unit that is unbeatable for high level performance.

From boiler outlet to atmosphere, depend on Thermix Fan Stacks to maintain predetermined, constant draft with full efficiency for your boiler.

Our project engineers will be glad to show you the advantages of Thermix equipment. Write for a complete catalog on your company letterhead. *All inquiries should be directed to*

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If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

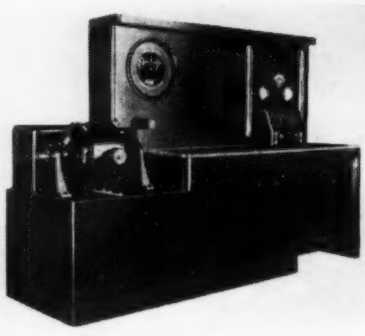
This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

Crapo **Steel Conductors are especially applicable to rural taps and branches where construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.**

Crapo **Steel Conductors are distributed by Graybar Electric Company, Inc. Ask a Graybar representative for a copy of the *Crapo* Steel Conductor Manual or write direct for Manual No. 110-C.**

Indiana Steel & Wire Company
Muncie, Indiana

Crapo *Steel Conductors*



failure. Torque is read clockwise on scale, regardless of direction of rotation by dynamometer, and is also read directly in foot-pounds. Dimensions: 9 ft long, 6 ft high, 3 ft deep.

•

Temperature Controllers

A SERIES of temperature controllers designed for use with furnaces, ovens, pots and other applications has been announced by K. H. Huppert Co, 6830 Cottage Grove Ave, Chicago 37, Ill. The device, known as the Infitrol, allows current to the heating element at definite periods which is a percentage of the total time, an amount sufficient to maintain definite temperatures.

A pyrometer can be furnished, calibrated to 2,000 F or other temperatures desired. The standard controller is designed for 115-v a-c operation and is reported to give complete control over any temperatures within the range of the heating device.

•

Troffer Units

A NEW SERIES of fluorescent troffer units, known as Togl-trof, has been announced by Mobilite, Inc, 440 Mercer St, Jersey City, N. J. The units have toggle-like clamps at the sides of the troffer, which, emulating the toggle bolt,

FOR **STRENGTH** AND **DURABILITY!** *Silicon* **BRONZE BOLTS**

Extra strength . . . resistance to corrosion . . . resistance to season cracking . . . these are some of the qualities of Harper Silicon bronze fastenings which have led to their use by scores of power companies and electrical equipment manufacturers. These fastenings go into sub station assemblies, pot heads, pole line hardware, grounding equipment, and a host of other applications.

5200 ITEMS IN STOCK

Harper maintains a large and widely assorted stock of Silicon bronze bolts, nuts, screws, washers, and rivets. Moreover, similar stocks are maintained in brass, naval bronze, copper, Monel and stainless steel. Ask for summarized catalog.

ASK HARPER ENGINEERS

Harper engineers specialize in the manufacture and use of non-ferrous and stainless fastenings. Submit your fastening problems to them.

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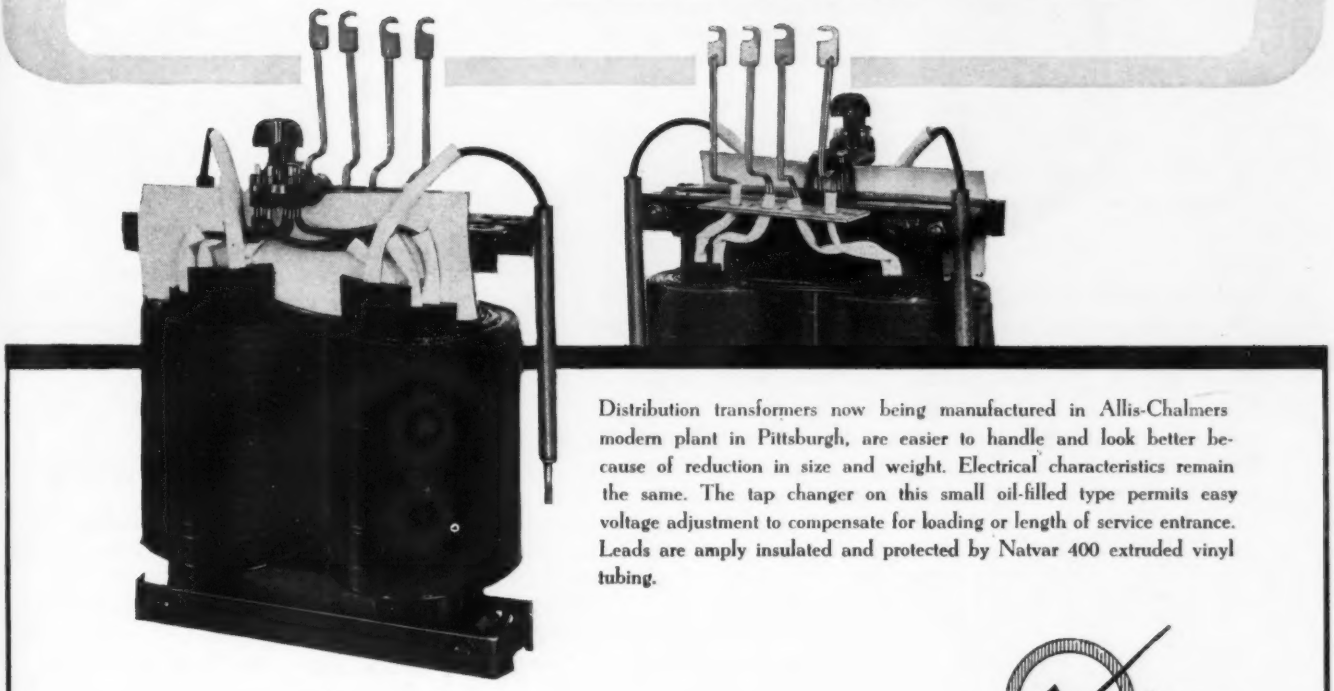
EVERLASTING FASTENINGS

ALLIS-CHALMERS INSULATES AND PROTECTS TRANSFORMER LEADS

WITH NATVAR 400



Distribution transformers now being manufactured in Allis-Chalmers modern plant in Pittsburgh, are easier to handle and look better because of reduction in size and weight. Electrical characteristics remain the same. The tap changer on this small oil-filled type permits easy voltage adjustment to compensate for loading or length of service entrance. Leads are amply insulated and protected by Natvar 400 extruded vinyl tubing.

With capacity at an all-time high, utilities are doing an outstanding job of keeping up with the relentlessly increasing demand.

Allis-Chalmers distribution transformers, in serving widening areas and areas of increasing density, have handled loads far in excess of their rated capacity for considerable lengths of time without interruption.

Natvar 400, approved for continuous operating temperatures of 105°C., gives lasting insulation and protection to the leads because of its uniformly superior resistance both to high temperatures and to oil.

Prompt deliveries — either from the stock of a wholesaler near you — or direct from our own. Full Underwriters' report on request.

Natvar

Natvar Products

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- Varnished canvas
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- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing
- Extruded vinyl identification markers

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THE NATIONAL VARNISHED PRODUCTS Corporation

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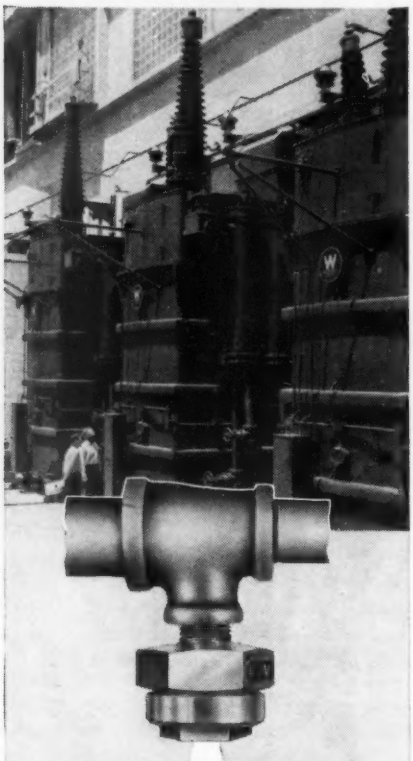
BLAW-KNOX
FOG SYSTEMS
OPERATE WITH THE SPEED OF ELECTRICITY



Activated by electric rate-of-rise supervised thermostats, they attack the fire instantly.

They spread a smothering cloud of fog over the fire, at the same time driving through to its base with a finely divided spray, cooling and quenching burning oil and inflammables.

Clear passages in these nozzles prevent clogging, and their spray pattern is maintained in emergencies even with reduced pressures.

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SPRINKLER DIVISION
OF BLAW-KNOX CONSTRUCTION COMPANY
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Pittsburgh 12, Pa.
Offices in Principal Cities

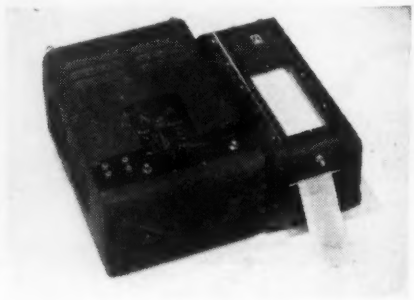
grip the upper surface of the ceiling and automatically suspend the fixture.

Units are 12 by 48 in. and are provided with spring release of hinged bottom for relamping or maintenance. The fixtures are available in 2, 3 or 4-lamp units, in open type, Linex glass bottom or baffle type louvres.

•

Strain Amplifier

RECENTLY DEVELOPED model BL-310 amplifier, when used with the company's direct-inking oscillograph, forms a package unit for measurement of



strains. It is a product of the Brush Development Co, 3405 Perkins Ave, Cleveland 14, Ohio.

The equipment records either static or dynamic strains up to 100 cps, and direction as well as magnitude of the measured strain can be read from the chart, according to the manufacturer. The amplifier contains two legs of a Wheatstone bridge. Third and fourth legs are connected externally by the user, one being the active gage, the other for sensitivity doubling or temperature compensation. Power requirement is 135 w at 100-125 v, 60 cycles.

•

Jumper Sleeves

A NEW SERIES of Nicopress jumper sleeves and a Nicopress tool are available for jumper splicing of ACSR in sizes 2/0, 3/0, 4/0 and 266, 800 cir mils. They are a product of National Telephone Supply Co, 5098 Superior Ave, Cleveland 3, Ohio.

Sleeves are comparatively the same in outside diameter so that only the one tool is required for installation of all four sizes. The tool is toggle action, hand operated, 35 in. long, weighs 12 lb, contains a single groove and bears number 3-1285.

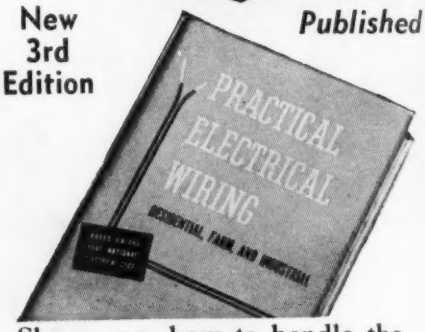
•

Test Leads

RETRACTABLE TEST leads have been announced by Koiled Kords, Inc, Hamden, Conn. These test leads, in red and black colors, are made in 48-in.

Here's the answer!
to your everyday wiring problems

Just Published
New 3rd Edition



Shows you how to handle the medium-voltage wiring jobs most in demand today

Practical Electrical Wiring

Residential, Farm and Industrial
Based on the 1947 National Electrical Code
by H. P. RICHTER
Member, International Association of Electrical Inspectors
574 pages, 466 illustrations, $3.75

A COMPLETE course of instruction for those who want to learn more about electrical wiring. Designed for on-the-job guidance, this manual shows you how to do hundreds of medium-voltage wiring jobs in accordance with code requirements. It contains a minimum of mathematics—a maximum of tested, easy-to-follow methods and procedures—it shows not only *what* to do, but explains clearly *why* a job should be done in the manner shown.

See this valuable handbook for:

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—descriptions of bulbs, sockets, outlets, switches, fuses, fixtures, wires, conduits, cables, boxes, connectors, switchboards, etc.
—instructions on handling and installing these devices
—simple analysis of lighting requirements
—step-by-step description of basic wiring methods
—practical interpretation of the code requirements for wiring for motors
—specific pointers on wiring homes, farm buildings, small factories, offices, stores, theatres, etc.

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ELECTRICAL WORLD

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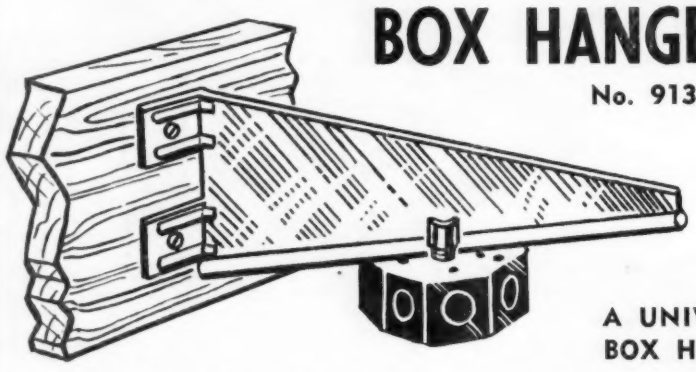
use **KEES** *adjustable* **OUTLET BOX HANGERS**

No. 9139



A UNIVERSAL BOX HANGER

Yes, Kees adjustable outlet box hangers are easier, and quicker, too! There's no need to notch the joist. For "offset" Kees hangers may be fastened to higher or lower side of joist. Box may be adjusted to any position from close to ten inches out from joist.

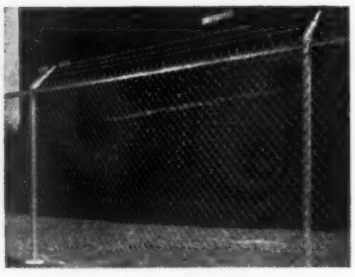
More easily installed than a bar hanger. Fastens to joist with 3 nails. Bracket is heavy pressed steel ten inches long. Three inches wide at nailing end. Rigid and amply strong. Lower edge is formed into tube on which the fixture-stud slides. Stud can be positioned exactly. Comes complete with fixture-stud and over-size notched locknut. (Outlet box not furnished). Write for complete information.

Can be used for mounting any type of box and fixture from any type ceiling using any wiring.

KEES

F. D. KEES MFG. CO. BEATRICE NEBRASKA

PROTECTED *by a* **STEWART FENCE**



Stewart Style 3TH Chain Link Wire Fence as illustrated offers the utmost protection for all types of industrial property. This fence is also available in style 5TH which carries five strands of barbed wire. Other Stewart products for industrial use include: Iron Picket Fence and Entrance Gates; Wire Mesh Partitions; Wire and Iron Window Guards; Steel Folding and Sliding Gates; All Steel Settees; Flagpoles; Wire Trash Baskets, etc. When writing for literature please mention products in which you are especially interested.

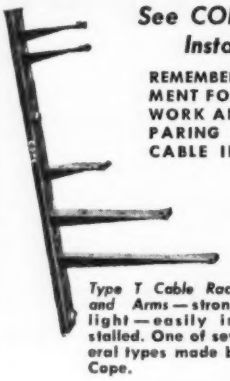
THE STEWART IRON WORKS CO.
INCORPORATED
1566 STEWART BLOCK, CINCINNATI 1, OHIO

Stewart IRON and WIRE FENCES

WORKING ON UNDERGROUND LINES?

See COPE for the Finest Installation Tools

REMEMBER *COPE* MAKES EQUIPMENT FOR—PROTECTION OF WORK AND WORKERS—PREPARING AND INSTALLING CABLE IN CONDUITS



Type T Cable Racks and Arms — strong, light — easily installed. One of several types made by Cope.

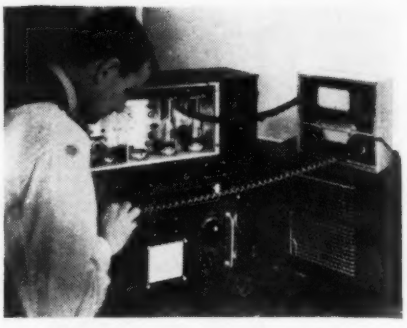
Men Working Sign — strong yet easily handled — withstands wind and tough weather — A Warning Sign That Really Protects.

Type 264 Manhole Guard Rail — SOLID — GOOD-LOOKING — *A Protection for You.* Available with or without panels.

Write for the Cope Catalog.

T. J. Cope Inc.
713 South 50th Street
Philadelphia 43, Pa.

CABLE INSTALLATION & MAINTENANCE TOOLS & EQUIPMENT



retracted lengths which will extend to 20 ft. The 48-in. retracted coil may be cut into any desired length; the ratio is one foot of retracted cord to 5 ft extended. Any type of test lead terminals may be applied.

•

Boiler Feed Pumps

A SERIES OF VERTICAL, multistage, centrifugal pumps designed for pumping hot water at high pressures is an addition to the line of pumps produced

by Jacuzzi Bros, Inc, Richmond, Calif. and St. Louis, Mo.

Standard units range in sizes for 4 to 72 gpm, 20 to 420 psi, 1½ to 2 in. inlet, ¾ to 2 in. discharge, ½ to 20 hp motors. Water is forced upward through the impellers, increasing in pressure with each stage.

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Address Corrected

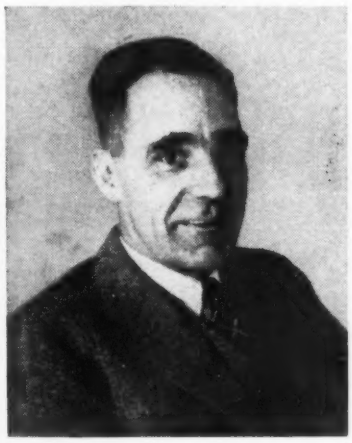
ROME CABLE CORP is located at Rome, N. Y. When a listing of a non-metallic sheathed cable, Roflex, was included in Electrical World, March 27, 1948, page 138, the manufacturer's address was given erroneously as Rochester, N. Y.

NEWS ABOUT PEOPLE

O. J. Miller Named General Manager of Duke Power

O. J. Miller, superintendent of operations, Duke Power Co, Charlotte, N. C., since 1943, has been appointed general manager. Mr Miller joined the Duke Power staff after an association with the Commonwealth & Southern Corp at Jackson, Mich. He is an electrical engineer of wide experience, having been associated with the utility industry since 1916 when he joined E. W. Clark & Co of Columbus, Ohio.

In 1920 Mr Miller became identified with the Tennessee Electric Power Co as engineer in charge of various operating and construction activities. After four years he became superintendent of production, operations and maintenance and subsequently manager of the production and transmission department. When the Tennessee Electric Power electric facilities were sold, Mr Miller was made manager of the transportation system in Nashville. It was in 1940 that he joined Commonwealth & Southern in Jackson.



O. J. MILLER

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▶THOMAS J. STIVERSON, who has been connected with the Columbus and Southern Ohio Electric Co, Columbus, for more than 30 years, and treasurer since 1935, has been elected vice-president and treasurer.

▶JAMES V. GALLAGHER, formerly connected with the Jersey Central Power & Light Co, Asbury Park, has been appointed power engineer with the Tide Water Power Co, Wilmington, N. C. Mr Gallagher had been identified with Jersey Central Power & Light for 18 years as division power engineer and manager of industrial power.

▶JACK L. MCDONALD, who has been a new business representative for Arizona Edison Co, Inc, Phoenix, has been promoted to new business and advertising manager. Mr McDonald has served with the Arizona Edison for 10 years with the exception of three years spent in military service during World War II.

•

New Appointments Made by West Penn Power Co

Announcement has been made by the West Penn Power Co of the promotion of several employees to new positions.

J. K. Walter, who has been supervisor of training for the operating department, has been made training supervisor, with the responsibility of coordinating the training activities in all departments of the company. Mr Walter joined West Penn in 1934 as a meter reader. Charles F. Anderson, assistant to the superintendent at Connellsville power station, has been made staff assistant in the power generating department. He will supervise training activities in that department and will also have other specially assigned duties relating to personnel and organization matters affecting all generating stations. Mr Anderson started with West Penn in 1934.

Earl J. DeChambeau, now engaged in a special apprentice training course, has been promoted to supervisor of training for the operating department. He will coordinate training activities within the operating department. Mr DeChambeau started with the company in 1934.

Thomas B. Giles, line foreman at Greensburg, has been named assistant manager of Connellsville district. James F. Wolfe, assistant district manager at Connellsville, will continue in that capacity, and together with Mr Giles, will assume responsibilities for conducting the operating department training school, particularly as it applies to the training of linemen and servicemen.

A. Iddles Elected President of Babcock & Wilcox Co

A. G. Pratt, formerly president of the Babcock & Wilcox Co, New York, was elected chairman of the board at a recent meeting of the board of directors. Alfred Iddles, previously a vice-president, has been elected president and chief executive officer of the company to succeed Mr Pratt.

A. IDDLES

W. T. McCullough, Jr, who has been in charge of stationary boiler sales and was formerly sales manager of the Chicago office, has been elected a vice-president. W. G. Dryden, formerly treasurer, is now secretary and treasurer. C. W. Middleton, vice-president and secretary, has withdrawn from full-time active service in the company, but will continue as a director and in a

W. T. McCULLOUGH, JR

consulting capacity.

Mr Pratt has been with the company for 45 years, during seven of which he served as a vice-president and 24 years as president.

Mr Iddles, who has been engaged in engineering and construction work all his business life, joined the company in 1937 and became a vice-president in 1945.

•

Three New Vice-Presidents Elected by Locke, Inc

Announcement has been made by Locke Incorporated, Baltimore, of the election of three new vice-presidents.

E. M. HAINES

Edward M. Haines has been made vice-president in charge of marketing; Richard D. Gleason in charge of employee and community relations, and E. M. Skipper in charge of manufacturing.

Mr Haines joined General Electric,

R. D. GLEASON

of which Locke is an affiliate, in 1934 on the management training program. The following year he became identified with the G.E. Supply Corp and subsequent connections followed with John Chatillon & Sons in New York and the

E. M. SKIPPER

Fred Goat Co. In 1947 he joined the staff of the Affiliated Manufacturing Companies Department of General Electric and later that same year became marketing manager of Locke.

Mr Gleason joined the Locke organization in 1946 as manager of employee and community relations. He previously had been identified with Robert Reis Co, New York, as advertising manager and later director of industrial relations.

Following graduation from Johns Hopkins in 1928, Mr Skipper joined Locke in the design engineering department. In 1934 he became plant engineer. Four years later he was appointed manufacturing engineer and in 1945 was promoted to the position of assistant works manager.

W. B. Dixey 3rd has been appointed assistant merchandising manager. He was formerly associated with the apparatus advertising and sales promotion divisions of General Electric Co in Schenectady.

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▶ B. S. Moss has been appointed agricultural agent for the Georgia Power Co, Atlanta. He was formerly rural engineer for the Columbus division. Directing his activities to the advancement of agriculture in the territory served by the company, Mr Moss will work in coordination with established agricultural agencies over the state and with the company's rural and community development divisions.

▶ Everett J. Rutan, a member of the firm of Shaw-Rutan, Inc, consulting engineers, has established his own engineering practice with offices at 32 Court St, Brooklyn 2, N. Y. Mr Rutan was connected with Consolidated Edison Co earlier in his career for 23 years. He has been active in the American Institute of Electrical Engineers and in the American Society for Testing Materials.

Central Cable Corp Names McArdle Sales Manager

Announcement has been made by the Central Cable Corp, Jersey Shore, Pa., of the appointment of Frank McArdle as general sales manager.

Following World War I, Mr McArdle was associated with the Copperweld Steel Co from 1919 to 1923 in the Chicago office. In the latter year he became identified with the Illinois Wire & Cable Co, one of the predecessor companies of the Anaconda Wire & Cable Co, continuing with that organization until 1938.

Then he affiliated himself with the Midland Wire Corp, Tiffin, Ohio, as

F. McARDLE

vice-president in charge of sales and during the past four years has been vice-president and general manager of that company.

•

▶ Earl H. Eacker has been elected president of the Boston Consolidated Gas Co. A graduate of the Massachusetts Institute of Technology, he entered the utility field in 1923 as electrical superintendent of the Charlestown Gas & Electric Co. He joined the Consolidated company in 1931; was identified with electrical problems and was rapidly promoted to increasing executive duties in the following years.

▶ E. R. Godfrey, vice-president of General Motors and general manager of the Frigidaire Division, has been appointed group executive in charge of the Dayton and household appliance divisions of the corporation, with headquarters in Detroit. Mr Godfrey will be succeeded as general manager of the Frigidaire Division by Mason M. Roberts, who is now factory manager of the Frigidaire Division. B. D. Kunkle, vice-president of General Motors, who is now group executive in

PERMANENTLY INSULATED TO RESIST HEAT FUMES - OIL - GREASE - MOISTURE - FLAME

1 2 3 4 5
ROCKBESTOS A. V. C.
(asbestos and varnished cambric insulated)
For Motor Leads, Control and Power Circuits, Switchboards, etc.
1 4 5
ROCKBESTOS ALL-ASBESTOS
(impregnated asbestos and asbestos braid)
For Rheostats, Grid Connections, Power Leads, Furnaces, Apparatus, etc.
4 5
ROCKBESTOS PLAIN ASBESTOS
(felted asbestos insulation; various impregnants)
For Instrument Leads, Ranges, Fixtures, Appliances, etc.

From the three basic designs illustrated Rockbestos has developed a complete line of 125 failure resisting wires, cables and cords, a few of which are described. All have the same performance guaranteeing characteristics detailed below. Write for a catalog or samples.

Rockbestos Permanent Insulation Insures Long-Lived Service

1. A tough impregnated asbestos braid, resistant to heat, flame, moisture, oil, grease, alkalies and corrosive fumes.
2. Felted asbestos insulation impregnated with heat, flame and moisture resisting compounds will not dry out with age, burn, or bake brittle under high temperatures.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance — protected from heat, flame and oxidation by felted asbestos walls.
4. Impregnated asbestos insulation that withstands heat of overloads and aging and won't become brittle, crack, rot or burn.
5. Conductors are perfectly centered in helically applied non-flowing insulation and will always remain so.

ROCKBESTOS 300 VOLT HEAT RESISTING FIXTURE WIRE
(Underwriters' Type AF)
Sizes No. 10 to 18 AWG stranded plain copper conductor insulated with black or white impregnated felted asbestos—with or without braid.

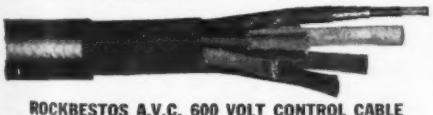
Rockbestos asbestos insulated fixture wires, approved by the Underwriters' Laboratories for lighting fixture wiring, will not bake out under the high socket temperatures developed in modern high-wattage fixtures. Also used for small motor and apparatus leads, switchboards, etc.

ROCKBESTOS A.V.C. 600 VOLT SWITCHBOARD WIRE
(National Electrical Code, Type AVB)
Sizes No. 18 to No. 4/0 AWG with varnished cambric and impregnated asbestos insulation and gray, black, white or colored flameproof braid.

Combine fire insurance and fine appearance in your switchboards with flame and heat resistant Rockbestos A.V.C. Switchboard Wire. Takes right angle bends without cracking because asbestos wall acts as a cushion beneath braid. Rockbestos A.V.C. Hinge and Switchboard Bus cables have same characteristics.

ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA)
Sizes No. 18 AWG to 2,000,000 CM insulated with laminated felted asbestos, varnished cambric, and asbestos braid. Other constructions for service voltages to 5000.

This cable is recommended for power leads of heat-exposed equipment and circuits that run near boilers, steam lines, furnaces, kilns and other hot spots. It withstands high ambient and conductor temperatures and has ample moisture resistance.



ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE
In one to 19 conductors with individuals insulated like Motor Lead Cable, cotton braid covered and cabled with an asbestos braid over all. Standard strandings AWG No. 12—19/#25 and No. 9–19/#22. Other strandings on order.

Designed for applications requiring a multi-conductor control cable capable of withstanding high temperatures, corrosive fumes, oil, grease and moisture. It also eliminates fire hazard as it will not burn. Used by equipment manufacturers, power companies, steel mills.

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(National Electrical Code, Type AVA)
Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

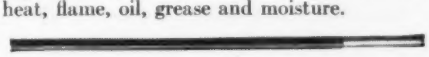
For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard around furnaces, ovens, lehrs, soaking pits, boilers, etc., this permanently insulated wire is ideal. It won't bake brittle, crack, rot, flow or swell.

ROCKBESTOS THERMOSTAT CONTROL WIRE
Sizes No. 14, 16 and 18 AWG in two to five conductors with .0125", .025" or (for 115 volt service) .031" of impregnated felted asbestos insulation and steel armor.

A multi-conductor wire for fuel burner controls, safety pilots, intercommunications and signal systems. Heatproof, fireproof insulation and steel armor give trouble-proof circuits.

ROCKBESTOS A.V.C. 600 VOLT MOTOR LEAD CABLE
(National Electrical Code, Type AVA)
Size No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated asbestos and a high-dielectric varnished cambric insert, with a heavy asbestos braid overall.

Use this apparatus cable for coil connections, motor and transformer leads exposed to overloads or high ambient temperatures. It makes a permanent installation as it is resistant to heat, flame, oil, grease and moisture.



ROCKBESTOS ASBESTOS INSULATED MAGNET WIRE
Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.

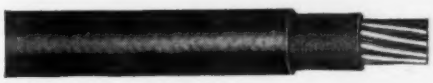
Protect motors against heat-induced breakdowns with Class B windings of heat resisting magnet wire. Rockbestos A.V.C. Motor Lead Cable completes the failure-proofing.

ROCKBESTOS 300 VOLT HEAT RESISTING DUPLEX FLEXIBLE CORD
(Underwriters' Type AFPD)
Sizes No. 10 to 18 AWG stranded plain copper conductors insulated with impregnated felted asbestos, polarized, twisted together and covered with a cotton braid.

This heat-resisting cord is approved for use in lighting fixtures and is recommended for pendant types as it does not dry out or crack at the socket. Also on apparatus and appliances which develop heat in operation or are used in hot, dry places. Twisted pair, tripled or triplex constructions also available.

ROCKBESTOS A.V.C. 600 VOLT FLEXIBLE CORD
Sizes No. 10 to 18 AWG with two or three conductors insulated with impregnated felted asbestos, varnished cambric, felted asbestos, covered with heavy impregnated asbestos braid.

A heavy duty, high-dielectric, heat and moisture resistant flexible cord used in locomotive cab circuits, high wattage lighting units, floodlights and for leads on apparatus exposed to heat. Specify polarized conductors if desired. For high temperature applications where resistance to moisture is not required specify All-Asbestos insulated constructions.



ROCKBESTOS ALL-ASBESTOS 600 VOLT RHEOSTAT CABLE
(National Electrical Code, Type AIA)
Sizes No. 18 AWG to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this cable for wiring rheostats, switchboards, elevator and locomotive control panels and equipment exposed to heat, fumes or fire hazard — also for open power circuits in hot, dry locations. For flexible conductor specify Rockbestos All-Asbestos Flexible Apparatus Cable — for solid conductor, Rockbestos All-Asbestos Rheostat Wire.

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charge of the Overseas, Canadian, Dayton and household appliance group, will continue as group executive of the Overseas and Canadian Operations and in addition will have other special assignments.

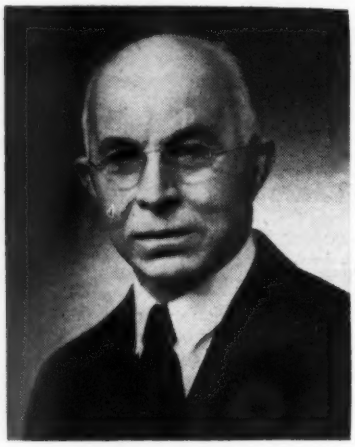
•

R. C. Muir Made Manager, Nucleonics Department

Formation of the nucleonics department by the General Electric Co, with responsibility for operation of the Hanford Works at Richland, Wash., and for contractural administration and negotiations in connection with the company's nucleonics project, has been announced.

Roy C. Muir, who recently retired as GE vice-president and general manager of the apparatus department, has returned to active service as general manager of the new department. Headquarters are at the Hanford Works, atomic energy plant which GE is operating for the Atomic Energy Commission.

The company's chemical department



R. C. MUIR

formerly had responsibility for the activities now centralized in the new department. The Knolls atomic power laboratory at Schenectady will continue to be operated by the laboratory for the commission.

Mr Muir retired last January after the completion of 42 years of service with the company. He had been a vice-president since 1933 and general manager of the apparatus department for three years.

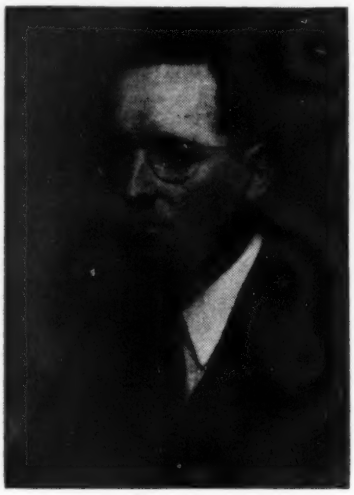
•

▶ BENTLEY BARNABAS, sales promotion and advertising manager for Kansas Gas & Electric Co, Wichita, since 1940, and an employee of the company for more than 20 years, has resigned to serve as sales promotion manager for S. A. Long & Co.

OBITUARY

DeNyse W. Atwater

DeNyse W. Atwater, manager of commercial engineering for the Westinghouse Lamp Division, Bloomfield, whose death was recently announced (EW, Apr 17, p 4) was prominently associated with the illuminating engineering field for a number of years.



Joining Westinghouse at Bloomfield in 1920 as a lamp engineer, he soon became identified with every pioneering movement in modern lighting. In 1923, he designed the lighting for the National Shrine Convention in Washington, D. C., and in 1926 he was in charge of illuminating the buildings for the Philadelphia Sesquicentennial, where he adapted colored floodlighting to a large-scale exposition for the first time. At the Century of Progress Exposition in Chicago in 1933, Mr Atwater cooperated in the initial application of colored floodlighting to tinted buildings. He assisted in the lighting of the New York World's Fair, the Holland Tunnel and the San Francisco Fair.

Mr Atwater was responsible, perhaps as much as any individual, for helping to lead a nationwide campaign for improved lighting in industries, commercial establishments and homes. His activities as a member of the executive committee of the Better Light-Better Sight Bureau were among his closest interests.

Active in the affairs of the Illuminating Engineering Society for a number of years, he served as its president for the 1938-39 term, was secretary for three years and in the course of his association with that society served on various committees. He served for two years as chairman of the illumination group of the New York section of the American Institute of Electrical Engineers.

He was the author of many articles on lamps and lighting in the trade and technical press, and spoke on these subjects in many cities of the United States and Canada.

In 1942 Mr Atwater was named manager of the Westinghouse illuminating engineering department, becoming manager of commercial engineering when the two departments were consolidated in 1945.

•

▶ JAMES ECHERSLEY, head of the meter department of the Toronto Hydro-Electric System, Toronto, Ont., died suddenly April 1 in that city at the age of 66. Born and educated in England, Mr Echersley came to Canada as a young man and had been associated with the Toronto Hydro for 34 years.

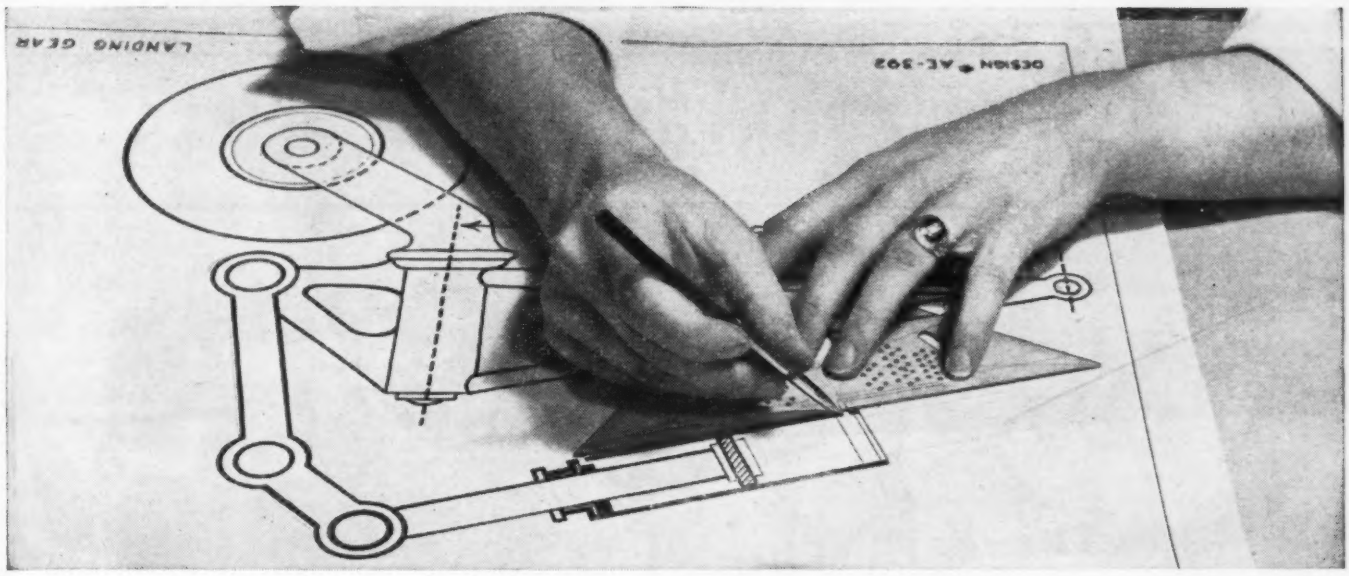
▶ JOHN J. MOLYNEAUX, retired vice-president and treasurer of Northern States Power Co, Minneapolis, died on April 12 at his home in that city. He was 67 years old. Mr Molyneaux had retired from his position with the company in 1943 after 26 years of service. Born in Chicago, he was identified with the Oklahoma Gas & Electric Co before going to Minneapolis in 1917 to become treasurer of Northern States. He was made vice-president and treasurer in 1931, remaining in that position until his retirement.

▶ A. C. EDDY, formerly chief engineer of way and structures for the B. C. Electric Co, Vancouver, died on March 8 at his home in that city. He was 71 years old. Of New England birth, Mr Eddy first went to the Northwest half a century ago to aid in building the Great Northern Railroad between Seattle and the Canadian border. He was in charge of the company's construction and maintenance of way from his appointment as engineer of way in 1914 until his retirement in 1946.

▶ LOUIS G. BROWN, at one time sales manager for the Buffalo Niagara Electric Corp in Niagara Falls for a period of 20 years, died on March 26 at the age of 79. Subsequently he was associated with the sales staff of the Republic Light, Heat & Power Co until his retirement several years ago.

▶ CARLTON A. SEARS, superintendent of residence sales for Buffalo Niagara Electric Corp, Buffalo, N. Y., was killed instantly Apr 1 in an automobile accident. Mr Sears had been associated with the power company since 1925.

▶ FRANKLIN E. BLAUSEY, 72, retired superintendent of distribution for the Southern California Edison Co, died on Mar 31 at his home in Redondo Beach.



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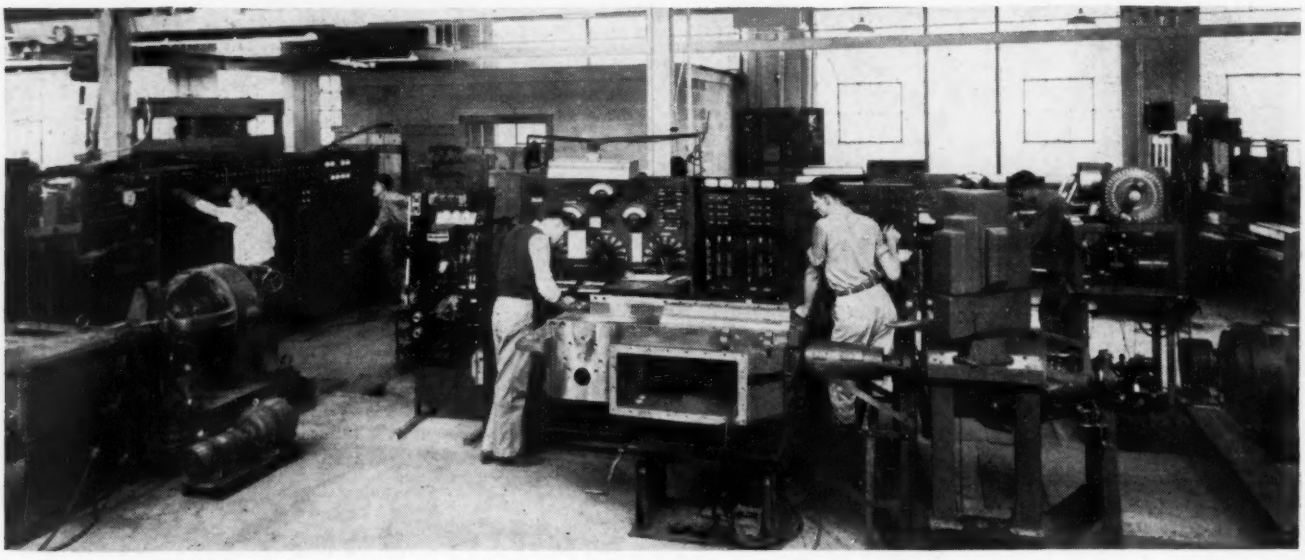
MANUFACTURERS and MARKETS



DYNAMOMETERS AND TEST STANDS in the general experimental laboratory at Reliance Electric & Engineering Co's newly expanded engineering, development, and service center for 1 to 400-hp motors and speed control equipment

Reliance Electric and Philadelphia Gear Will Join in Manufacturing Gearmotors

Reliance Electric & Engineering Co, Cleveland, has joined with the Philadelphia Gear Works, Inc, in the cooperative manufacture of a line of gearmotors from 1 to 60 hp.

This announcement has been made by J. W. Corey, president of Reliance, and Russell C. Ball, president of "Phillie" Gear Works.

Concurrently with the announcement of its alliance with Philadelphia Gear Works, Reliance also announced the introduction of a new chemical motor of special corrosion-resisting design for Class I-Group D (hazardous) locations and the conversion of one of its smaller manufacturing plants in Cleveland into an expanded engineering development and service center for 1 to 400-hp motors and speed-control equipment.

Under the working agreement between the two companies, Philadelphia Gear will cut and assemble gears for the new gearmotor. Reliance will supply the motors. Both companies will sell the finished product. Both company name plates will be on motors.

In discussing the cooperative venture, Ball said that Philadelphia Gear will be ready to assemble gears and motors into the finished product by the end of June.

"In addition to building tools and patterns for the manufacture of the gear trains, we are in the process of completing an addition to our Philadelphia plant which should enable us to get into substantial production with very little delay."

Introduction of its new gearmotor and chemical motor lines and the organization of its engineering and development center are the most recent of a series of post-war expansion moves made by Reliance since 1945. Other steps taken by the company in the last two years include: (1) Expansion of warehouse and material handling facilities at the company's Ivanhoe (heavy motor) division in 1946; (2) construction of a $1,500,000 plant at Ashtabula, Ohio, where a-c and d-c motors from 1 to 20 hp have been coming off the line since August, 1947; and (3) improvement of manufacturing operations in Cleveland.

Reliance Electric & Engineering Co was founded in 1905. Its early activities were directed largely toward the design of improved electric motors, particularly d-c motors with a wider range of operating speeds. Gross company sales have risen from $20,000 in 1906 until today when 1948 sales are expected to top $22,000,000. The company now specializes in making a-c as well as d-c electrical equipment including motors, generators, motor-generators, gearmotors, and specially designed power and control equipment for heavy industries.

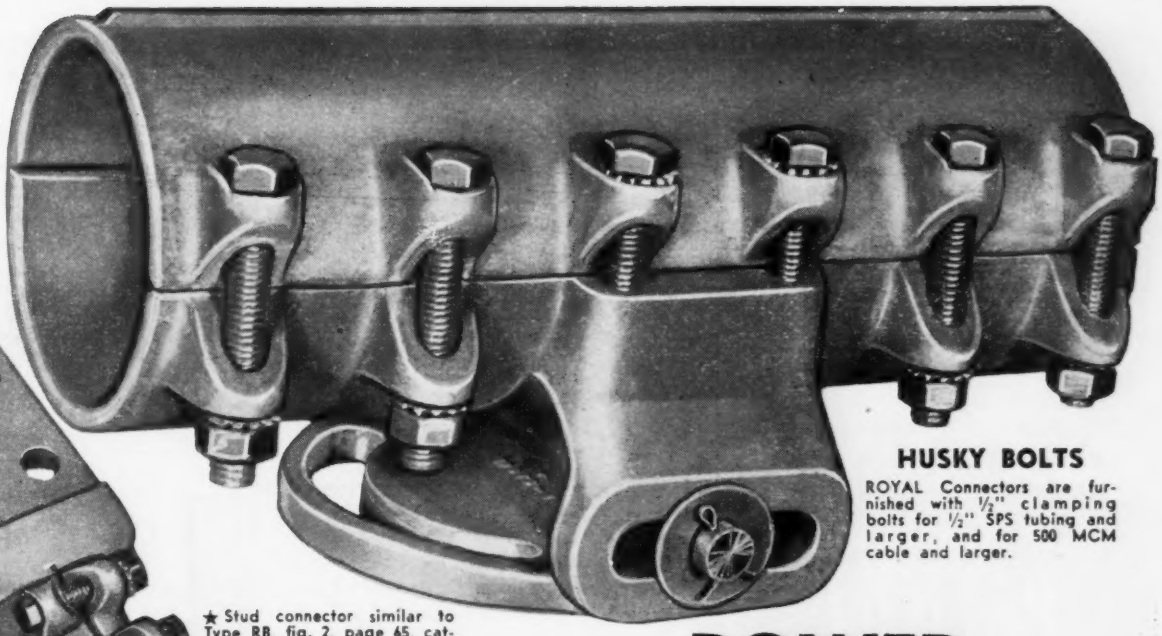
Philadelphia Gear Works, its ally in the gearmotor enterprise, had its beginnings in 1892 in a modest plant in Philadelphia. Since then the firm has outgrown this and one other plant. It has made three separate additions to its newest Philadelphia plant, built in 1928. The latest addition is being designed, built, and equipped for the manufacture of gear trains for the new Philadelphia-Reliance gearmotor. Today, "Phillie" Gear produces a complete line of gears, speed reducers, and "Torque" motor operated valve controls.

•

RCA Institute Opens New, Expanded Quarters in N. Y.

In an expansion program designed to meet the needs of a growing student body, RCA Institutes, radio and television school division of the Radio Corp of America, has opened in newly established quarters at 350 West Fourth St, New York, a nine-story business building occupying the block front between Horatio and Gansevoort Sts.

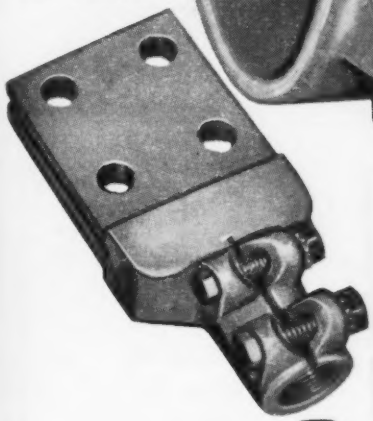
Separate laboratories are provided



★This special adaption of Type PHC slide bus support coupler was developed for use with 4" type O copper tubing. Increased length and four additional bolts permit long bus spans. This design is assembly drawing **5398-A.**

HUSKY BOLTS

ROYAL Connectors are furnished with ½" clamping bolts for ½" SPS tubing and larger, and for 500 MCM cable and larger.



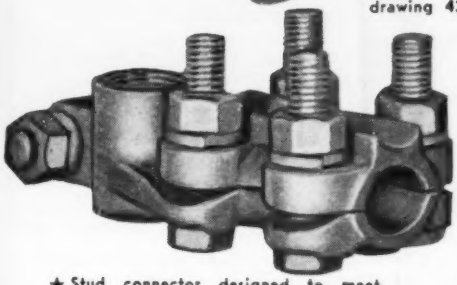
★ Stud connector similar to Type RB, fig. 2, page 65, catalog No. 11. Special contact tongue is provided for two ¼" x 4" BARS. Stud connection is tapped 1"-14 to meet apparatus manufacturers specification. Design is assembly drawing **4369-A.**

POWER CONNECTORS

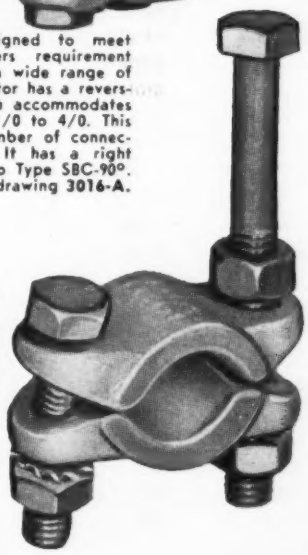
for specific applications . . .

ROYAL'S extensive line of power connectors is tailored to meet individual applications. Your particular standard requirements are easily met. The power connectors shown in our Catalog were developed over a period of years through close cooperation with utility engineers.

Standard listed connectors will not meet every application or requirement. If our Catalog does not show the exact type you require we will produce it for you. Our development and production engineers are ready now to cooperate on any connector problem.



★ Stud connector designed to meet switchgear manufacturers requirement for a fitting to cover a wide range of cable sizes. This connector has a reversible keeper piece which accommodates **No. 6 to No. 1 and 1/0 to 4/0.** This feature reduces the number of connectors carried in stock. It has a right angle take off similar to Type SBC-90°. The design is assembly drawing **3016-A.**

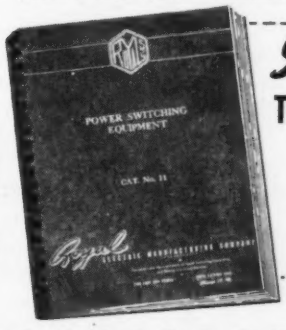


★ This ground or transformer tap clamp was designed at the suggestion of a utility engineer to provide an economical and easy means for making a connection to the station bus. The hot line clamp is attached to the extended arm which can be furnished parallel or 90° to bus. Type DD listed on page 59, Catalog No. 11.

EXCLUSIVE FEATURE . . . . . .

The bolt heads in Royal Fittings are prevented from turning. One casting is provided with ears which nest the bolt head. This permits the use of standard hex head bolts, readily obtained anywhere. The entering and leaving edges of these fittings are throated. This results in a dampening effect on conductor vibration and eliminates any possible hard spot or localized stress.

NESTED BOLT HEADS



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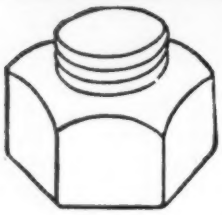
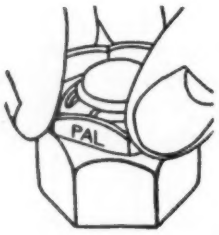
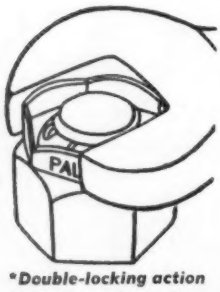
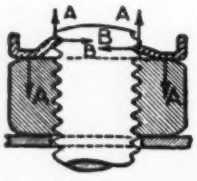


THIS ORDINARY ASSEMBLY, consisting of bolt and regular nut, can be kept absolutely tight in service



. . . WITH THE ADDITION OF A PALNUT LOCKNUT which spins on easily on top of regular nut and **BECOMES A VIBRATION - PROOF ASSEMBLY** when the "Palnut" is tightened with a wrench. Double-locking action* keeps bolt and nut secure.





***Double-locking action**

Arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.

• "Palnuts" are available in full range of sizes, in plain, parkerized, cadmium and hot dip galvanized finishes. Send for samples and literature.

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for instruction in such courses as physics, radio physics, electrical technology, transmitters, receivers, ultra-high frequencies, audio and video circuits, television, radio codes and drafting.

Included in the courses are studies covering the servicing of radio and television receivers, station operating in radio communications services, operational and laboratory work in broadcast and television stations and development and design of radio and electronic equipment.

•

Hold Line Against Runaway Prices, O'Conor Advises

"Prices of Formica products as sold to the user have been increased very little—some of them have not been advanced at all during the past year—and we are doing what we can to hold the line against run-away prices," D. J. O'Conor, president of the Formica Insulation Co, Cincinnati, declared in his annual report to stockholders.

Mr O'Conor reported, "prospects for 1948 are favorable with a sizeable volume of orders on the books" but cited that "the margin between cost of products and selling price is constantly getting closer, necessitating vigilance for maintaining most efficient operations if a satisfactory profit is to be made."

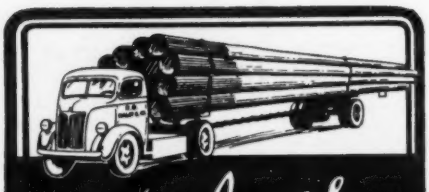
Mr O'Conor advised that "the small increases in prices of Formica materials as sold to users have not been in proportion to the increased cost of labor and material." He added that "the need to maintain the most efficient operations, utilize technical improvements and better workmanship to bring costs in line with selling prices which cannot be increased further without great loss of volume of business is paramount." He said that decline in volume of business would result in decreased employment and probably wipe out all possible profits.

The company's net sales in 1947, he added, "were the highest of any non-war year in the history of the company, but on that large volume of sales, the net profits were less than 5%."

•

Has Home Freezer Film

"Surprise for Janie!" a 16-mm sound film emphasizing the diversified use of the home freezer in the life of an American family, is now available for free showings from Kelvinator distributors. The picture is suitable for general adult audiences, homemaking groups, and high school and college home economics classes. The picture can also be secured directly from the company, 14250 Plymouth Road, Detroit 32, Mich.



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Recent Rate Changes

PENNSYLVANIA POWER CO, New Castle, Pa., has reduced its residential electric rates to about 50,000 customers in the New Castle area. The reduction, totaling $254,862 a year, has been approved by the Pennsylvania Public Utilities Commission. Bills of 50,511 customers in Lawrence, Mercer, Butler, Beaver and Allegheny Counties will be cut about $267,301 a year, company officials said, while rates of 816 customers, residential and industrial, will be increased $12,439 annually. Charges to 10,005 others will remain unchanged. Although rates have been lowered, the company is applying an extra coal charge to all classes of customers except residential and water heating service.

SASKATCHEWAN POWER COMMISSION, Regina, Sask., will reduce its rates early this summer, Hon. J. L. Phelps, Minister of Natural Resources, has announced. Mr Phelps said the top domestic block rate of 9 cents would be reduced to 8 cents; other domestic rates would be cut by approximately half a cent; commercial power rate of 2¼ cents would be reduced to 2 cents. The eight-cent rate, according to Mr Phelps, would benefit rural consumers as well. He estimated that on the basis of the amount of electricity now used in Saskatchewan the saving to consumers in this reduction would be more than $100,000 a year.

ALABAMA POWER CO has been ordered by the state Public Service Commission to cut its commercial rates an average of 20 percent. Commission President Gordon Persons stated the order will mean an annual savings of some $353,000 for 25.824 commercial customers. The new commercial rates will become effective on bills dated after May 1 and will lower the minimum bill from $1 to 75 cents.

BARGERSVILLE (IND.) HEAT, LIGHT & POWER CO has reduced its rates 20 to 30 percent, beginning April 1. The utility is owned by the town of Bargersville.

•

Sangamo Declares Extra

Sangamo Electric Co, Chicago, has declared an extra dividend of 30 cents a share on common stock.

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NEW ELECTRICAL CONSTRUCTION

A weekly selection of U. S. electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is indicated or implied

UTILITIES

Proposed Construction

California—Bureau Reclamation, Dpt. Interior, 824½ J. St., Sacramento, 69 kv. transmission line, Contra Costa Substation to Clayton and Ygnacio Pumping Plants, Central Valley Proj., Spec. 2166.

Colorado—Empire Electric Assoc., Cortez, 32½ mi. rural distr. line, 28½ mi. transmission line, sys. imprvs. and completing previously approved construction. Dolores Co. **$460,000.**

Fla., Green Cove Springs—Yards & Docks Annex, Navy Dpt., Arlington, Va., exten. 13.2 kv. power line and imprv. distr. sys. at Naval Station, Spec. 19823. Plans deposit $10.

Ind., Indianapolis—Bd. Trustees, Indiana University, J. B. Franklin, treas., Admin. Bldg., Bloomington, steam and electric distr. sys., underground tunnel, conduit sys., asbestos-cement piping (4-in diam.) with 3 in. concrete jacket, vacuum and sump pumps, manholes, c.i. rings, covers, power station, switching equip., 750 kva. transformer, 4,160 volt electric feeder, etc. Medical Center, W. Michigan St. **$300,000.** Ammerman, Davis & Stout, 912-23 K of P Bldg., consult. engr.

Ind., Rensselaer—Bd. P. Wks., J. Merritt, secy., Rensselaer, 2,000 kw. diesel engine and generator, switchgear for municipal power plant.

La., Plaquemine — Town, altering 2,300 volt electric distr. sys. Plans deposit $5. Barnard & Burk, 314 Triad Bldg., Baton Rouge, engrs.

Minnesota — Rural Co-operative Power Assn., E. Walters, mgr., Maple Lake, facilities, incl. generating plant, 11,500 kw. steam power sys., 30 mi. transmission lines, Wright, Meeker, Kandiyohi, McLeod, Hennepin, Chicago, Anoka, Insanti, Kanabec, Mille Lacs, Pine, Benton and Sherburne Counties. **$6,000,000.** United Eng. Service, 600 Kasota Bldg., Minneapolis, consult. engr.

Mississippi — Pearl River Valley Electric Power Assoc., Columbia, 215 mi. rural distr. lines, sys. imprvs., completing previously approved construction, Marion Co. **$600,000.**

Missouri — Crawford Electric Co-operative, Bourbon, 288 mi. rural distr. lines, Bourbon Co. **$505,000.**

Montana—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Miles City, outdoor power transformers, automatic voltage regulating transformer, outdoor distr. transformer, outdoor power circuit breaker, outdoor disconnecting switches, outdoor station-type lightning arresters, outdoor-type current transformers, outdoor-type potential transformer for use on 69,000 volt line-to-line sys. for Miles City substation, Fort Peck Proj., Spec. 2198. Walker R. Young, Denver, ch. engr.

New Mexico—Bureau Reclamation, El Paso, Tex., addnl. structures for 115 kv terminal facilities at Elephant Butte Power Plant and Socorro and Alamogordo substation, Rio Grande Proj., Spec. R5-2 (Region 5). Walker R. Young, Denver, ch. engr.

N. Y., Long Island City—Dpt. P. Wks., Municipal Bldg., New York Zone 7, installing underground electric conduit and high tension cables at Wholesale Live Poultry Market, Borden Ave. and 11 St. Plans deposit $5.

Okla., Blackwell—City, power plant, power piping, boiler erection, electrical work, boiler setting, insulation and ventilation. $175,000. Black & Veatch, 4706 Broadway, Kansas City, Mo., consult. engrs.

South Dakota — Clay-Union Electric Corp., Vermillion, 62 mi. rural distr. lines for 6 substations, 56 mi. rural distr. lines and completing previously approved constr., Clay Co. **$710,000.**

Wash., Seattle—City, County — City Bldg., Zone 4. Gorge powerhouse addn., installing addnl. equip., **$4,314,505;** switching station, **$368,687;** transmission line to Seattle, **$791,187;** addnl. penstock at Gorge plant, **$944,000;** concrete dam to replace present timber crib diversion dam at Gorge Creek, **$1,385,416;** streamlining 2 mi. 20½ ft. tunnel from diversion dam to Gorge powerhouse, **$980,000;** altering tunnel intake, **$341,000;** suspension bridge at Gorge Creek, **$50,730,** at Newhalem. E. R. Hoffman, City Light Bldg., city light supt.

Wis., Laona—Connor Lumber & Land Co., Laona, 1 story, rein.-con., brick diesel electric generating plant. $165,000. Mead & Hunt, 550 State St., Madison, engrs.

Low Bidders & Contracts Awarded

Conn., Ridgefield — Schlumberger Well Surveying Corp., 2720 Leeland St., Houston, Tex., 1 story, 50x225 ft., brick, stucco, steel electronic research laboratory, to T. J. Riordan, Hoyt and Clark Sts., Norwalk. Est. **$68,000.** J. W. Shallenberger, 886 Main St., Bridgeport, engr. Bids 3/10.

Indiana—Indiana & Michigan Electric Co., Geo. F. Dequine, supt. Power Distr. & Transmission, 220 W. Colfax Ave., South Bend, 7 8/10 mi. 132,000 volt power line from Twin Branch Plant to Elkhart Co. line, 45 steel towers, **$250,000.** American Gas & Electric Co., 30 Church St., New York, N. Y., engr.

Tennessee—Upper Cumberland Electric Membership Corp., Carthage, 300 mi. rural distr. lines, Smith Co., from Utilities Constr. Co., 600 Exchange Bldg., Nashville. **$379,837.**

Wyoming—Bureau Reclamation, Dpt. Interior, Building 1-A, Denver Federal Center, Denver, Colo., Schedules 1 and 4, Gering-Alliance and Cheyenne-Pine Bluffs 115 kv transmission lines, Missouri Basin Proj., Spec. 2125 to Utilities Constr. Co., 151 4 Ave. N., Nashville, Tenn. **$663,252.** Bids 4/1.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Calif., Los Angeles—Bd. Supervs. Los Angeles Co., 501 Hall of Records, plans by Claude Beilman & Herman Spackler, 1019 Union Bank Bldg., 5 story, bsmt., 285,000 sq. ft., floor space, municipal courts bldg., air conditioning, etc. **$6,250,000.** A. C. Martin & Assoc., 333 S. Beaudry Ave., engrs.

Ind., Indianapolis—State Conservation Dpt., John Nigh, dir., 140 Meridian St., plans by Beine, Hall & Curran, 607 Broadway, Gary, and Walter Scholer & Assoc., 1114 State St., Lafayette, assoc. archts., 4 story, brick, rein.-con., structural steel, stone State Conservation and Museum bldg. **$2,500,000.**

N. Y., New York—New York City Housing Auth., 122 E. 42 St., Zone 17, plans by Julian Whittlesey, Harry M. Prince, Robert J. Reilly, 101 Park Ave., Zone 17, Colonial Park Houses, 890 dwelling units on site bounded by W. 154 St., W. 159 St., 8 Ave. and Colonial Park, **$12,000,000;** plans by York & Sawyer, 101 Park Ave., Zone 17, St. Nicholas Houses, 840 dwelling units on site bounded W. 127, W. 129 Sts., 7 and 8 Aves., **$12,000,000.**

Low Bidders & Contracts Awarded

Ala., Childersburg—American Development Co., c/o contractor, rayon plant, to Daniel Constr. Co., 822 7 Ave. S., Birmingham. Est. **$20,000,000.**

Mass., East Boston—Commonwealth of Mass., Dpt. P. Wks., Boston, Apr. 9, airline station bldg., at General Logan Airport, from J. F. Fitzgerald Constr. Co., 214 Essex St., Boston. **$3,663,948.**

Utah, Salt Lake City—Utah Oil Refining Co., Utah Oil Bldg., propane de-asphalting plant, to M. W. Kellogg Co., 225 Broadway, New York, N. Y. Est. **$2,500,000.**

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LETTERS TO THE EDITOR

Students Averse to Utilities

To the Editor of ELECTRICAL WORLD:

The article "Has Electronics Eloped With Engineers?" appearing in the October 11, 1947 ELECTRICAL WORLD was very interesting. Except for a few depression years, when any job was acceptable, power companies have always had a hard time interesting young engineers. Several reasons for this situation were diplomatically outlined in the article; however, a number of them were omitted. I would like to mention a few which have come to my attention.

For a number of years it has been my lot to work with undergraduate students in the engineering department of a large electric utility. Later, I was engineering advisor for high school students. I have often been surprised at the insight students have of the various professions.

Glamor of electronic work in a laboratory or for a manufacturer is truly enticing. Nor is the high salary paid in these fields everything. Consider a few other reasons:

1. The equipment offered the graduate in the electronic field is new, as contrasted with the old, obsolete equipment being used by most utilities. Most of it was purchased in the twenties and has long since ceased to have any glamour. Electric utilities are now old organizations and very much set in their ways.

2. Offices and laboratories in the electronic field are, in general, new. Working conditions are good. Contrast this with the old offices and dirty plants offered by many utilities.

3. Local politicians are usually chosen for the manager's positions rather than the engineers. This leaves the profession a dead-end for the engineer and his future prospects are very much limited.

4. The engineer in the utility is caught in a pinch between the nontechnical electrician or lineman and the politician. Engineers who are department heads often prefer to advance men from the ranks instead of graduate engineers. It is easier for them to hold their jobs as department heads with no competition from younger engineers. Linemen and electricians often work their way up to responsible engineering positions.

The young graduate now has his pick of organizations at a good salary. The electric utilities realize that this condition will not last, so they are biding their time until technical help can be secured at a lower figure.

B. E. ELLSWORTH
North Platte, Neb.

TECHNICAL LITERATURE

Tantalum — Tabulation of physical properties and some discussion on workability, machinability, weldability and fabricating techniques are contained in a 20-page booklet supplied by Fansteel Metallurgical Corp, North Chicago, Ill.

Transformers — Revised sheets have been issued for the NEMA Specialty Transformer Standards publication 45-98. They include control, high-reactance, signalling, ignition, doorbell and cold-cathode lighting transformers. Copies may be obtained from National Electrical Manufacturers Association, 155 East 44th St, New York 17, N. Y.

Fans—"Standards for Fans" publication 47-128 covers test, rating, performance and manufacturing of a-c and d-c fans of the desk and bracket type, pedestal type, ceiling type, ventilating type and air circulators. Copies are obtainable from National Electrical Manufacturers Association, 155 East 44th St, New York 17, N. Y.

Welding Electrodes—A 25x35-in. wall chart shows procedures for various types of arc-welding electrodes, also welding symbols for both fusion and resistance welding. It has been prepared by the Hobart Brothers Co, Troy, Ohio.

Rubber—"Symposium on Rubber Testing" comprises eight technical papers, making available to industry the accomplishments of Government and industry during the war when secrecy had to be maintained. Copies of the 112-page publication can be procured from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa., at $2 each.

Insulation Resistance—Instructions for connecting and operating Megger insulation testing instruments, directions for testing various electrical equipments, and methods of interpreting insulation resistance tests, are contained in a 76-page pocket manual obtainable from James G. Biddle Co, 1316 Arch St, Philadelphia 7, Pa., at 50 cents each.

Conversion Apparatus—"Application of Electric Conversion Equipment to the Electrochemical Industry" is a compilation of six papers and covers the broad aspects of the use of mercury-arc rectifier in the zinc, magnesium, chlorine, aluminum, copper, and the mining and smelting industries. This special 34-page publication is available from American Institute of Electrical Engineers, 33 West 39th St, New York 18, N. Y.

Bearing Alloys—Physical properties, chemical composition, hardness, characteristics and typical uses of different cast bronze-bearing alloys are provided in 12-page booklet obtainable from The Bunting Brass & Bronze Co, Toledo 9, Ohio.

Safety Directory—"Safety Directory" for 1948, Second annual edition, is designed to cover the fields of safety, fire protection and control, hygiene, first-aid and sanitation, also combines features of a safety manual directory, index, encyclopedia and catalog. The 494-page volume, priced at $5, is made available by Alfred M. Best Co, 75 Fulton St, New York 7, N. Y.

Potheads—"Standard for Potheads" includes definitions and terminology, ratings, heating, and test code; is publication No. 48, price 60 cents to non-members, issued by American Institute of Electrical Engineers, 33 West 39th St, New York 18, N. Y.

Bushings—"Standard for Roof, Floor, and Wall Bushings," publication No. 49, gives service conditions, rating, definitions and terminology, and test code, and is issued by American Institute of Electrical Engineers, 33 West 39th St, New York 18, N. Y.

SEARCHLIGHT SECTION

(CLASSIFIED ADVERTISING)

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A LARGE non ferrous relling mill, located in Alabama has an opening for an electrical engineer either a recent graduate or one having not more than 5 years experience. Appointments will be made for applications favorably considered. P-4666, Electrical World.

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SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (38 years recognized standing and reputation). The procedure of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

ENGINEERS: LARGE college offers $3000 approximately half time teaching-studying. Positions of all ranks for masters $4000-10,000. Cline Teachers Agency, East Lansing, Mich.

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ELECTRIC METER Superintendent or Assistant 26 years experience in meter work, testing, repairing, installing, reading, switchboard wiring and other meter work. Employed but desire to make a change, permanent job, have taken a meter engineering course. Age 46, good health. PW-4569, Electrical World.

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ELECTRICAL ENGINEER—31, 8 years diversified experience. Presently employed Field Engineer for large electrical manufacturer. Desires to improve position. Willing to travel. 3 years experience field engineering, 1½ years special assignments and equipment design, 3½ years plant engineering, same factory employing 10,000. 17 months G.E. Test Course. BSEE 1939. Available reasonable notice. PW-4624, Electrical World.

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Fully qualified men only. Please give full details, experience, age, availability, and past salaries. Attach photograph. All replies confidential.

P-4496, Electrical World,
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POWER PLANT SUPERINTENDENT

Large public utility, building new power plant with initial capacity of 132,000 KW, needs immediately, high grade operating man fully experienced in modern power plant operation using high pressure steam, (1250 lbs. per sq. in.) and pulverized coal. Permanent opportunity for thoroughly qualified man to take complete charge of operation of plant, maintenance, handling of all labor, etc. Send full details of experience, in confidence, to

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Wanted by high voltage switchgear mfr. as factory representatives to cover middle west, salary plus bonus basis. Age 27 to 40, with accredited Univ. E. E. degree and experience in high voltage switchgear field required. In replying, give full details.

S&C ELECTRIC COMPANY
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Electrical Meter Engineering

"The Profession With a Future"

Meter Department demands are bringing good opportunities to meter experts.
HOME STUDY COURSE
Practical up-to-date home study covers all phases of Meter Work
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DESIGNERS, CHECKERS ELECTRICAL ENGINEERS

with Power Plant Design Experience

CORBETT, TINGHIR & CO.
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U. S. PARTNER WANTED

Having been exclusive Canadian agent for several years for a number of British concerns manufacturing electrical & mechanical apparatus (some patented), catering to heavy industry—mine—mill—marine, am contemplating opening U. S. office provided suitable engineer partner can be located. 50% interest in U. S. alone require at least $50,000.00.

BO-4652, Electrical World
330 West 42nd Street, New York 18, N. Y.

WANTED
YOUNG ENGINEER for ELECTRIC SYSTEM DISPATCHING

Large Northern New England Utility has opening for a young man with electrical engineering training who is interested in Power System Dispatching and Operating. Experience in hydro and steam generation preferred. Early interview will be arranged for qualified applicant.
Address:

PUBLIC SERVICE COMPANY
of New Hampshire
1087 Elm St., Manchester, New Hampshire

ELECTRICAL ENGINEERS

Graduate as Project Engineer, experienced in design, engineering and economic studies of steam-electric power plants and high voltage substations.

Also

Graduate, experienced in power system relaying and in preparation of specifications for switchboards and switchgear.

Submit complete resume to

P-4641, Electrical World,
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TURBO GENERATORS

TURBINE OF THE MONTH

1—750 KW—GE—450 lb. I.S.P. Condensing 3 ph., 60 cy., direct conn. exciter. Built in 1943.

1—3000 KW Whse. 3750 KVA, 2300v, 3 ph., 60 cy. with Parsons 200 lb. cond. turbine
1—2000 KW G.E. 6600v, 3 ph., 60 cy. with 175 lb. cond. turbine and dir conn. exciter
1—1500 KW G.E. 2300v, 3 ph., 60 cy. with G.E. 225 lbs cond. turbine, surface condenser
2—1250 KW G.E. 2300v, 3 ph., 60 cy. with 175 lbs. condensing turbine
1—1250 KW Al Ch. 2300v, 3 ph., 60 cy. with 200 lb. condensing turbine, surface condenser
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Power Transformers

Young engineer with 3 to 5 years power transformer experience either with manufacturer or utility.
To develop small power transformers for well established midwestern manufacturer.
Excellent opportunity for the future.

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SELLING OPPORTUNITY OFFERED

Representatives or distributors wanted, preferably those now calling on utilities, industrial plants, etc., to offer new patented line of insulation testing apparatus. Please give full information about yourself.

ATLANTIC ELECTRIC METER CORPORATION
214 East 41st Street, New York 17, N. Y.

NEW TRANSFORMERS

200—15 KVA oil cooled, 1 Ph. 60 cy. Pri. 13200 x Sec. 110/220 V. PROMPT SHIPMENT.

PHILADELPHIA TRANSFORMER CO.
Box 566 Dalton, Pa.

ELECTRICAL ENGINEER

Age 27 to 35, with accredited Univ. E. E. degree and supervisory experience in high voltage switchgear field required, wanted for responsible application engineering position in sales department of high voltage equipment mfr. In replying, give full details.

S&C ELECTRIC COMPANY
4435 Ravenswood Avenue Chicago 40, Illinois

Mechanical Design Engineer

With Administrative Experience
in the Design of Steam Electric Stations
Preferably Between 35 and 45 Years of Age
LARGE EASTERN UTILITY
All Replies Strictly Confidential
P-3325, Electrical World
330 West 42nd Street, New York 18, N. Y.

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2—30,000 Foot Pound Capacity, Gate Shaft type oil pressure governors, manufactured by S. Morgan Smith Co., 110 volt motor driven flyballs. Without pumps. Immediate delivery.

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